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PARTNERSHIP FOR ECONOMIC GROWTH PROGRAM (PEG)

PESTICIDE EVALUATION REPORT AND SAFER USE ACTION PLAN (PERSUAP)

Submitted FEBRUARY, 2015
Submitted by DAI to USAID Somalia

PARTNERSHIP FOR ECONOMIC GROWTH PROGRAM (PEG)

**PESTICIDE EVALUATION REPORT AND SAFER USE ACTION
PLAN (PERSUAP)**

FEBRUARY 11, 2015

DISCLAIMER

The authors' views expressed in this publication do not necessarily reflect the views of the **United States Agency for International Development** or the **United States Government**.

**U.S. Agency for International Development
INITIAL ENVIRONMENTAL EXAMINATION AMENDMENT—PERSUAP
USAID Somalia Partnership for Economic Growth Program
Implemented by Development Alternatives, Inc. (DAI)**

PROJECT NAME: Partnership for Economic Growth (PEG, formerly known as SEGLI—Somalia Economic Growth and Livelihood's Initiative) South Central Somalia (SCS)

REGION/COUNTRY: East Africa/Somalia

PROGRAM AREA: Economic Growth

ORIGINATING OFFICE: Somalia Office

CURRENT DATE: September 2014

IEE AMENDMENT: Yes

PREPARED BY: [REDACTED], PhD, MBA and [REDACTED], BSc

IMPLEMENTATION START: April 1, 2011 (SEGLI/PEG); October 1, 2013 (SCS added)

LOP AMOUNT: \$12,989,232 (SEGLI/PEG) + \$8,000,000 (Phase II including SCS)

IMPLEMENTATION END: September 30, 2020

Filename & date of original IEE: IEE - Somalia_EG_IIP_IEE_022411

ENVIRONMENTAL ACTION RECOMMENDED: (Place X where applicable)

Categorical Exclusion: _____ Negative Determination: **X**

Positive Determination: _____ Deferral: _____

ADDITIONAL ELEMENTS: (Place X where applicable)

CONDITIONS: **X** EMMP/SUAP: **X** PVO/NGO: _____

SUMMARY OF FINDINGS

Scope. The purpose of this Initial Environmental Examination (IEE) Amendment is to review activities under the SEGLI/PEG SCS. The PERSUAP also reviews activities approved in the original IEE.

Purpose. In compliance with USAID's Pesticide Procedures (22 CFR 216.3(b)), this PERSUAP:

- **Establishes the set of pesticides for which support is authorized** in USAID/Somalia Office's PEG Project for South Central Somalia.
- **Establishes requirements attendant to support for these pesticides** to assure that pesticide use/support (1) embodies the principles of safer pesticide use and, (2) per USAID policy, is within an Integrated Pest Management (IPM) framework.

These requirements come into effect upon approval of the PERSUAP.

The set of authorized pesticides and requirements for safer use are established through the first sections of the document, the Pesticide Evaluation Report (PER), which culminates with an assessment of the 12 pesticide risk evaluation factors (a through l) required by 22 CFR 216.3(b).

DAI's PEG SCS Project including subgrantees and partners will implement risk reduction and mitigation measures specified in this PERSUAP under the Safer Use Action Plan (SUAP). The SUAP provides a succinct, definitive stand-alone statement of compliance requirements, synthesized from the 12-factor analysis. It also provides a template for assigning responsibilities and timelines for implementation of these requirements. PEG's SCS project must complete this SUAP template and submit to its AOR/COR.

Approved pesticide Active Ingredients. Upon approval of this PERSUAP, the below-listed pesticide active ingredients (AIs) analyzed by this PERSUAP are permitted for use/support in USAID/Somalia Office PEG project for South Central Somalia. Toxicological summaries and EPA registration status are presented in the PERSUAP, Annex 5, repeated here, as well as in the Executive Summary, and repeated again in the SUAP.

Pesticide (AI)	Type	Target(s)	Crops/Livestock
garlic (<i>Allium sativum</i> oil extract)	artisanal insecticide	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
azadirachtin (neem tree, <i>Azadirachta indica</i> seed extract)	artisanal insecticide	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) Maize stalk borer (<i>Chilo partellus</i>); Maize aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>); Corn earworm (<i>Helicoverpa</i> = <i>Heliothis zea</i>, <i>H. armigera</i>) Legume pod borer (<i>Mauruca vitrata</i>); Legume aphids (<i>Aphis craccivora</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses) maize cowpea spinach
amitraz	livestock acaricide	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma</i>) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep

Pesticide (AI)	Type	Target(s)	Crops/Livestock
		<i>variegatum</i>)	
carbaryl	insecticide	<ul style="list-style-type: none"> Maize Aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>); Legume aphids (<i>Aphis craccivora</i>) Diamond Back Moth (<i>Plutela xylostella</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> maize cabbage spinach
capsaicin (chili pepper, <i>Capsicum oleoresin</i> , extract)	artisanal insecticide, miticide	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) Maize Aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>) Broad mite (<i>Polyphagotarsonemus latus</i>) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses) maize peppers/chilis
diatomaceous earth (mineral extract)	artisanal insecticide, livestock anti-helminthic	<ul style="list-style-type: none"> Livestock internal parasites and Helminths, Cysticercosis tapeworms, cestodes Facsiolosis flukes/trematodes Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep stored maize and cowpea
malathion	insecticide	<ul style="list-style-type: none"> Legume aphids (<i>Aphis craccivora</i>) Fruit Flies (<i>Ceratitis</i> species, <i>Dacus</i> species, and <i>Bactrocera</i> species) Western Flower Thrips (<i>Frankliniella occidentalis</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> cowpea melons onions spinach
permethrin	stored grain pests insecticide	<ul style="list-style-type: none"> Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> stored maize and cowpea
pirimiphos-methyl	stored grain pests insecticide	<ul style="list-style-type: none"> Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> stored maize and cowpea
pyrethrum (Chrysanthemum, <i>Tanacetum</i>)	artisanal insecticide, miticide	<ul style="list-style-type: none"> Tomato leafminer (<i>Tuta absoluta</i>) Armyworms (<i>Mythimna</i>) 	<ul style="list-style-type: none"> tomato Livestock fodder

Pesticide (AI)	Type	Target(s)	Crops/Livestock
<i>cinerariifolium</i> flower extract)		<i>unipuncta</i>)	crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
acetamiprid (recommended for use during vegetative growth, not during flowering to protect foraging honeybees)	insecticide, seed treatment insecticide	<ul style="list-style-type: none"> • Legume aphids (<i>Aphis craccivora</i>) • White fly (<i>Bemisia tabaci</i>) • Diamond Back Moth (<i>Plutela xylostella</i>) • Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> • cowpea, mung bean • tomato, melons • cabbage • spinach
beta-cyfluthrin (use formulations 10% and below)	livestock acaricide, insecticide	<ul style="list-style-type: none"> • Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) • Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) • Mange mites (<i>Demodex</i> and <i>Sarcoptes</i> species) • Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> • Livestock: camels, cows, goats, sheep • Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
deltamethrin (for all uses except on cotton)	livestock acaricide, insecticide	<ul style="list-style-type: none"> • Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) • Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) • Mange mites (<i>Demodex</i> and <i>Sarcoptes</i> species) • Tomato leafminer moth (<i>Tuta absoluta</i>) • Fruit Flies (<i>Ceratitis</i> species, <i>Dacus</i> species, and <i>Bactrocera</i> species) • Diamond Back Moth (<i>Plutela xylostella</i>) 	<ul style="list-style-type: none"> • Livestock: camels, cows, goats, sheep • tomato • melons • cabbage

Pesticide (AI)	Type	Target(s)	Crops/Livestock
		<ul style="list-style-type: none"> Whiteflies (<i>Bemisia</i> species) Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> okra Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
imidacloprid (recommended for use during vegetative growth, not during flowering to protect foraging honeybees)	insecticide, seed treatment insecticide	<ul style="list-style-type: none"> Maize stalk borer (<i>Chilo partellus</i>) Corn earworm (<i>Helicoverpa</i> = <i>Heliothis zea</i>, <i>H. armigera</i>) Legume aphids (<i>Aphis craccivora</i>) Tomato leafminer moth (<i>Tuta absoluta</i>) Melon aphids (<i>Aphis gossypii</i>) Diamond Back Moth (<i>Plutella xylostella</i>) Leaf miners (<i>Lyriomyza</i> species) White fly (<i>Bemisia tabaci</i>) Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> maize cowpea, mung bean tomato cabbage spinach tomato, melons, okra Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
cypermethrin (not for horticultural use)	livestock acaricide, stored grain crack & crevice treatment only	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> Livestock: camels, cattle, goats, sheep Stored maize and

Pesticide (AI)	Type	Target(s)	Crops/Livestock
			beans
sulfur (natural product)	natural miticide, fungicide	<ul style="list-style-type: none"> Broad mite (<i>Polyphagotarsonemus latus</i>) Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveillula taurica</i>) Anthracois (<i>Colletotrichum</i> species) Fungal diseases (<i>Phytophthora</i>, <i>Verticillium</i>, <i>Fusarium</i> species) 	<ul style="list-style-type: none"> peppers/chilis maize tomato, melons, peppers/chilis Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
copper oxychloride (natural product)—use only WHO Classes II and III formulations and use eye protection	natural fungicide	<ul style="list-style-type: none"> Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) Fungal diseases (<i>Phytophthora</i>, <i>Verticillium</i>, <i>Fusarium</i> species) Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveillula taurica</i>) Anthracois (<i>Colletotrichum</i> species) 	<ul style="list-style-type: none"> maize Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses) maize, melons peppers/chilis
potassium bicarbonate (natural product)	natural fungicide	<ul style="list-style-type: none"> Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveillula taurica</i>) Anthracois (<i>Colletotrichum</i> species) 	<ul style="list-style-type: none"> maize tomato, peppers/chilis peppers/chilis
chlorothalonil (use only Class II and III)	fungicide	<ul style="list-style-type: none"> Downy mildew (<i>Sclerospora</i> 	<ul style="list-style-type: none"> maize

Pesticide (AI)	Type	Target(s)	Crops/Livestock
products of less than 50% concentration, not Class I, and use eye protection)		<i>graminicola</i> , <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) <ul style="list-style-type: none"> • Corn leaf blight (<i>Helminthosporium maydis</i>) • Early blight on leaves (<i>Alternaria</i> species) • Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveillula taurica</i>) • Onion smuts (<i>Urocystis magica = cepulae</i> and <i>U. colchici</i>) • Powdery mildew (<i>Leveillula taurica</i> (imperfect stage = <i>Oidiopsis taurica</i>) 	<ul style="list-style-type: none"> • tomato • onion • peppers/chilis
glyphosate	herbicide	<ul style="list-style-type: none"> • Weeds of all crops (broadleaves, grasses) 	<ul style="list-style-type: none"> • all crops
glyphosate, isopropylamine salt	herbicide	<ul style="list-style-type: none"> • Weeds of all crops (broadleaves, grasses) 	<ul style="list-style-type: none"> • all crops

Other relevant requirements:

1. **Enforcement of accepted pesticide AIs, above:** Only pesticide AIs approved by this PERSUAP may be supported with USAID funds during PEG SCS training, promotion or use on demonstration activities and financed for procurement and use. These pesticides are enumerated in the above matrix. Additions or changes (in registration or restriction status) to the above list of PERSUAP-approved pesticide AIs will require yet another amendment of the original IEE as well as an amendment of this first PERSUAP Amendment to that IEE.
2. **Integrated Pest Management (IPM):** All of the above chemicals must only be used as part of an IPM program or Pest Management Plan (PMP), and after all other preventive tools/tactics (Annex 1) have been exhausted. These additional preventive tools/tactics may include any or all of the following: the use of resistant varieties, certified clean seed, treated seed, appropriate row spacing, careful watering, soil fertility and cultural methods, reliance upon natural predators and parasites of pests, daily monitoring, use of sticky and pheromone traps for both monitoring and control, control of pest and disease refuge weeds in and around crop, hand removal of pests, use of intercropping with companion repellent or trap crops, crop rotations, use natural and plastic soil mulches, harvest on time and at appropriate grain moisture content, remove heavily infested or infected plants, use of plastic or natural mulches to manage weeds, and removal of crop residues following harvest.
3. **Training:** Appropriate project staff & beneficiaries must be trained in safer pesticide use (SPU) and safety precautions (during handling, application, and storage etc.) and

pesticide first aid; PEG SCS, subgrantees and partners, supervisors, field officers, pesticide suppliers and dealers and pesticide users (farmers) will also be trained on their roles and responsibilities before, during and after use of pesticides. PEG SCS will build information on IPM and Safe Pesticide Use into all relevant trainings for implementers and beneficiaries that train on promotion or use of pesticides with project assistance. Training of farmers will incorporate IPM, using the attached Annex 1.

4. **Personal Protective Equipment (PPE):** To the greatest degree practicable, projects must require use & maintenance of appropriate PPE, in addition to pesticide purchase, handling, storage and disposal practices including demonstration activities. Women and children must be discouraged from participating in mixing and application of pesticides.
5. **Protection of the Ecosystem:** Measures will be taken to minimize risks to protected areas, reserves and parks including endangered or threatened species, non-target organisms and ecosystems (water table and fresh water fish, aquatic invertebrates, birds, mammals and beneficial insects, and so on), by proper site selection, application methods and timing as well as observance of requisite buffer zones from surface water bodies where applicable. In areas with sandy soil and high water tables, utilize pesticides with low ground water contamination potential will be utilized (Annex 5). Mitigation measures provided in the Safe Use Plan must be implemented.
6. **Livestock Acaricide/Insecticide Application Methods:** PEG SCS, subgrantees and partners staff **will not support the use of livestock dips** whereby a hole is dug in the ground, water and pesticides are filled in and animals are run through the bath. Instead, pour-on and spray-on formulations will be favored by the project.
7. **Disposal of Empty Pesticide Containers:** PEG SCS, subgrantees and partners must ensure that the farmers are trained on proper disposal of pesticide containers and discouraged from re use of the containers. Mechanisms for consistent handling, treatment and disposal must be implemented and disseminated to all implementing partners.
8. **Field Visits and Consultations:** Contracting and Agreement Officer Representatives (COR/AORs) in USAID's Somalia Office and the responsible Mission Environment Officer (MEO) will undertake field visits and consultations with implementing partners to jointly assess the environmental impacts of ongoing activities, and the effectiveness of associated mitigation and monitoring plans.
9. **Monitoring and Reporting:** PEG SCS, subgrantees and partners will prepare and implement the Environmental Monitoring and Mitigation Plan (EMMP) and Report (EMMR) quarterly. Projects must be systematic in their pesticide-related record keeping and monitoring and where possible use of professional field pest monitoring, spraying and record keeping services potentially offered by Agrovets, private sector agrodealers and/or extension agents.

B. MANDATORY INCLUSION OF ENVIRONMENTAL COMPLIANCE REQUIREMENTS IN SOLICITATIONS, AWARDS, BUDGETS AND WORKPLANS

1. Appropriate environmental compliance language shall be included in solicitations and awards for this activity with an appropriate level of funding and staffing to satisfy the environmental compliance requirements set forth in this IEE Amendment.
2. The implementing partner will incorporate conditions set forth in this PERSUAP into their work plans.

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Karen L. Freeman

Date

3/19/15

Concurrence:

Africa Bureau

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Date

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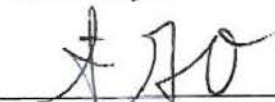
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ACRONYMS

AI	Active Ingredient (reference to chemical/s in pesticides)
A/COR	Agreement/Contracting Officer's Representative (USAID)
BEO	Bureau Environmental Officer (USAID)
BMP	Best Management Practice
BT	<i>Bacillus thuringiensis</i> (a bacteria that produces a toxin that is used as a pesticide)
CCD	Colony Collapse Disorder
CFR	Code of Federal Regulations (USA)
CLI	Crop Life International (private sector pesticide companies' trade association)
COP	Chief of Party (USAID)
DAI	Development Alternatives, Inc.
DCN	Document Number (USAID documentation system)
E	Emulsion (a pesticide formulation)
EA	Environmental Assessment
EC	Emulsifiable Concentrate (pesticide formulation)
EC50	Effective Concentration 50 (acute toxicity measure)
EG	Economic Growth
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan (USAID)
EPA	US Environmental Protection Agency (also known as USEPA)
EU	European Union
FAA	Foreign Assistance Act
FAO	Food and Agriculture Organization (United Nations)
FDA	Food and Drug Administration (USA)
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act (USA)
FRAC	Fungicide Resistance Action Committee
G	Granular (a pesticide formulation)
GAP	Good Agriculture Practice
GEF	Global Environment Facility (part of World Bank)
GlobalGAP	Global Good Agriculture Practices, a certification system
GMO	Genetically Modified Organism
GUP	General Use Pesticide
Ha	Hectares
HACCP	Hazard Analysis and Critical Control Points (processing standards system)
HRAC	Herbicide Resistance Action Committee
HT	Highly Toxic
ID	Identification
IEE	Initial Environmental Examination (USAID)
IGR	Insect Growth Regulator (type of pesticide)
IIP	Investing In People (USAID/Somalia)
IP	Implementing Partner
IPM	Integrated Pest Management

IRAC	Insecticide Resistance Action Committee
LC50	Lethal Concentration 50 (acute toxicity measure)
LD50	Lethal Dose 50 (acute toxicity measure)
LOP	Length of Project
M&E	Monitoring and Evaluation
MEO	Mission Environmental Officer (USAID)
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOLW	Ministry of Livestock and Wildlife
MRL	Maximum/Minimum Residue Level/Limit
MSDS	Material Safety Data Sheet
MSL	Meters above Sea Level
MT	Moderately Toxic
NAT	Not Acutely Toxic
NCAT	National Center for Appropriate Technology (USA)
NEPA	National Environmental Policy Act (USA)
NGO	Non-Governmental Organization
NIFA	National Institute of Food and Agriculture (USA)
OD	Oil Dispersion (a pesticide formulation)
OECD	Organization for Economic Cooperation and Development
PAN	Pesticide Action Network (pesticide NGO)
PEA	Programmatic Environmental Assessment (USAID)
PEG	Partnership for Economic Growth
PER	Pesticide Evaluation Report
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
pH	log of Hydrogen concentration, measure of acidity
PHI	Pre-Harvest Interval
PIC	Prior Informed Consent (a treaty, relates to toxic pesticides)
POPs	Persistent Organic Pollutants (a treaty, relates to toxic persistent pesticides)
PMP	Pest Management Plan
PNT	Practically Non-Toxic
PPE	Personal Protection Equipment
RCE	Request For Categorical Exclusion
R&D toxin	Reproductive and Developmental toxin
REA	Regional Environmental Advisor
Reg 216	Regulation 216 (USAID Environmental Procedures under 22 CFR 216.3 (b))
REI	Re-Entry Interval (safety period after pesticide spraying)
RUP	Restricted Use Pesticide
SATG	Somalia Agriculture Technical Group (sbu-grantee to PEG)
SC	Suspension Concentrate (a pesticide formulation)
SCS	South Central Somalia (PEG initiative)
SEGLI	Somalia Economic Growth and Livelihood's Initiative (renamed PEG)
SL	Soluble Liquid (a pesticide formulation)

S&C	Standards and Certification
SO	Strategic Objective
SOW	Scope of Work
ST	Slightly Toxic
SUAP	Safe Use Action Plan
UC	University of California
UN	United Nations
UNFAO	UN Food and Agriculture Organization (also known as FAO)
US	United States
USAID	US Agency for International Development
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency (also known as EPA)
VHT	Very Highly Toxic
WB	World Bank
WDG	Water Dispersible Granule (a pesticide formulation)
WHO	World Health Organization (United Nations)
WP	Wettable Powder (a pesticide formulation, usually for fungicides)

EXECUTIVE SUMMARY OF FINDINGS AND RECOMMENDATIONS

Risks are inevitably present with the use of pesticides and similar chemicals in sectors including agricultural crop and livestock production. The main purpose of a Pesticide Evaluation Report (PER) and Safe Use and Action Plan (SUAP) is to bring USAID-funded projects into full compliance with USAID's environmental regulations (Title 22 of the Code of Federal Regulations (CFR), part 216, or Regulation 216) on pesticide use. Beyond compliance, this document offers best practices and helps ensure that the USAID-funded project reduces the chances of environmental and health impacts that could occur during pesticide training, promotion or use. If a project desires to promote or use pesticides rejected by this PERSUAP analysis, it will need to perform an Environmental Assessment (EA) on those chemicals.

A number of the Somali areas that enjoy relative peace and stability have established functioning governance structures and favorable business environments that have facilitated investment in sectors including livestock, import and export, telecommunications, remittances, and more. These areas are now ripe for support to private sector development, investment, and economic policy development. The 2011-2015 USAID Partnership for Economic Growth (PEG) program works with local authorities and private sector groups to improve the enabling environment for investment and generate more productive employment and incomes.

PEG's objectives include helping local authorities and private sector groups improve the enabling environment for investment and generate more productive employment. Using a flexible approach that relies on detailed analysis before launching sub-activities, the Partnership has focused activities in South-Central Somalia on two areas: strengthening agriculture and dairy value chains. The activities in the agriculture sector in South-Central Somalia focus on various livestock and crops listed below.

Primary Pests/Diseases by PEG Targeted Livestock/Crops in South-Central Somalia

While Stem borers are a major pest of maize, white flies and aphids cause considerable damage to vegetable crops. A more thorough study on pests and disease and chemical control measure of the crops grown at the Agri-business incubation center is required. Below are listed the primary pests of PEG program target livestock and crops.

Potential Pests of Camels, Cattle, Sheep and Goats

- Savannah and Riverine species of Tsetse flies (*Glossina* species) that transmit trypanosomes to livestock
- Cattle ticks (*Rhipicephalus pulchellus*, *Boophilus decoloratus*, *Hyalomma marginatum rufipes*, *Amblyomma variegatum*) that transmit several diseases like Babesiosis and Anaplasmosis to livestock
- Mange mites (*Demodex* and *Sarcoptes* species)
- Biting flies/Tabanids (*Chrysops*, *Diachlorus*, and *Tabanus* species) that draw blood and agitate livestock, leading to weight loss
- Stable fly (*Stomoxys calcitrans*), some of which transmit trypanosomes to livestock

Potential Diseases of Camels, Cattle, Sheep and Goats

- Brucellosis bacteria (*Brucella abortus*)
- Mastitis bacteria (*Streptococcus* and *Staphylococcus* species)
- African Animal Trypanosomosis (AAT)
- Anaplasmosis

- Anthrax
- Babesiosis
- Contagious Caprine Pleurpneumonia (CCPP)
- Cysticercosis
- Facsialosis/Flukes
- Helminthes
- Lumpy Skin
- Peste de Petits Ruminants
- Pollurum
- Rabies
- Salmonellosis

Maize

- Stalk borer (*Chilo partelus*)
- Maize Aphids (*Rhopalosiphum maidis*, *Myzus persicae*)
- Corn earworm (*Helicoverpa* = *Heliothis zea*, *H. armigera*)
- Downy mildews (*Sclerospora graminicola*, *Peronosclerospora sorghi*)
- Leaf blight (*Helminthosporium maydis*)
- Maize Rusts (*Puccinia sorghi*, *Puccinia polysora*)

Legumes (Cowpea, Mungbean)

- Pod borer (*Mauruca vitrata*)
- Aphids (*Aphis craccivora*)

Maize & Legume Storage

- Granary Weevils (*Sitophilus* species)
- Aflotoxin contamination (*Aspergillus* species)

Tomato

- Broomrape parasitic weed (*Orobancha aegyptiaca*) infestation
- Tomato fruitworm (*Tuta absoluta*)
- White flies (*Bemisia tabaci*) that transmit Tomato Leaf Curl Virus (LCV)
- Early blight (*Alternaria* species)
- Powdery mildew (*Leveilula taurica*)

Onion

- Thrips (*Frankliniella occidentalis*)
- Onion smuts (*Urocystis magica* = *cepulae* and *U. colchici*)

Cabbage

- Diamond Back Moth (*Plutela xylostella*)

Spinach

- Leaf miners (*Lyriomyza* species)

Okra

- White flies (*Bemisia* species)

Peppers (chili pepper, sweet pepper)

- Powdery mildew (*Leveillula* species)

- Anthracnose (*Colletotrichum capsici*)
- Fusarium wilt (*Fusarium oxysporum*)
- Broad mite (*Polyphagotarsonemus latus*)

Melons

- Watermelon mosaic virus (WMV)
- Powdery mildew (*Oidium* species, *Sphaerotheca fuliginea*, *Erysiphe cichoracearum*)
- Fruit flies/maggots (*Ceratitis* species, *Dacus* species, and *Bactrocera* species)
- Whiteflies (*Bemisia tabaci*)

In addition, various legume and grass fodder species are grown as listed below, and are being tested at the Agri-business incubation center.

Fodder (Alfalfa legume, Dolichos legume, Sudan grass, Napier grass, Rhodes grass)

- Armyworms (*Mythimna unipuncta*)
- Weevils: Alfalfa Weevil (*Hypera postica*), Egyptian alfalfa weevil (*H. brunneipennis*)
- Fungal diseases (*Phytophthora*, *Verticillium*, *Fusarium* species)

Governing Initial Environmental Examination that Applies to Somalia Economic Growth Activities

In 2011, the USAID East Africa Regional Mission in Kenya that covers Somalia produced an Initial Environmental Examination (IEE) & Request For Categorical Exclusion (RCE) for all USAID/Somalia Investing In People (IIP) and Economic Growth (EG) Program Activities, of which SEGLI/PEG SCS was one.

Under the heading “Negative Determination with Conditions” (meaning that no full Environmental Assessment need be produced, but that specific conditions would apply), the document contained the following PERSUAP and pesticide language on page 7:

Pesticides: This IEE per se does not cover the procurement of pesticides, except as provided immediately below. Activities that entail the promotion or use of pesticides involving controlled experimentation, exclusively for the purpose of research, and field evaluation activities which are confined to small areas (e.g. < 4 ha.) and carefully monitored, shall be within the parameters of 22 CFR 216.3(b)(2)(iii) (Exceptions to Pesticide Procedures). All activities that fall outside of the category of controlled experimentation exclusively for the purpose of research and field evaluation under 22 CFR 216.2(c)(2)(ii) and entail the procurement or use, or both, of pesticides shall require the development and approval of a Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP).

That was the language that drives the production of this current 2014 PERSUAP that evaluates PEG activities.

Under “Categorical Exclusions” on page 4, the document has the following on pesticides:

Such **categorically excluded** activities carry the stipulation that if any topic associated with them is one that inherently affects the environment, such as training in pesticide and fertilizer use, then such topics will include information on how to minimize and/or mitigate these impacts. Examples include: i) instruction on safe disposal of excess fertilizers and pesticides, ii) training in proper household behaviors

to minimize exposure during insecticide application times or iii) training in the proper use of insecticides and fertilizers.

Later in the document, on page 27, in Table 4, under “Mitigation Conditions and/or Proactive Interventions” additional language on pesticides states:

If construction or rehabilitation requires use of fungicides or pesticides for termite control or any other reason, see also “Use of Pesticides” section below.

Primary Somalia PEG Agriculture Sector PERSUAP Findings

Generally, each country will have a functioning MOA (Ministry of Agriculture) or MOE (Ministry of Environment) that writes regulations on pesticide registration, import, distribution, transport, storage, sale, use and disposal. This same body would then oversee the registration of pesticides for import and use. Countries coming out of recent conflict, like Liberia, Sierra Leone, and South Sudan do not have, or are in the process of writing, such regulations. Resources are too limited.

Somalia is in the same situation, and does not yet have pesticide regulations or an official list of registered pesticides. Thus, in order to do an analysis of pesticides for PEG, this PERSUAP relied upon inventories of pesticides found to be present in weekly town markets, city and town bazaar tabletop markets and agriculture input stores that beneficiary farmers visit near project sites in South-Central Somalia.

For added safety, pesticide sprayers and applications should include provision by PEG and deployment of personal protection equipment (PPE), which is rare in South-Central Somalia. Correct use of pesticides is critical for ensuring safety in modern agriculture. Beyond safety of the people applying pesticides and their families, food safety for Somalis and export market consumers is critical.

Baseline PPE must be used for application of all pesticides and consists of chemical resistant rubber gloves, long-sleeved shirt, long pants, and shoes plus socks, all of which are washed and dried at the end of each day’s spraying. For pesticides that are listed as acute toxicity class/category II, additional PPE is generally found listed or pictogrammed on the product label as required, and is listed below as follows:

- Amitraz – baseline plus rubber boots, and/or aprons (if livestock application)
- Carbaryl – baseline plus rubber boots, and/or aprons (if livestock application)
- Chlorothalonil – baseline plus chemical-resistant face shield or goggles
- Copper oxychloride – baseline chemical-resistant face shield or goggles (acute toxicity class/category II or III)
- Beta-Cyfluthrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Cypermethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Deltamethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Imidacloprid – baseline plus boots
- Malathion – baseline plus rubber boots, and/or aprons (if livestock application)
- Permethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Pirimiphos-methyl – baseline plus chemical-resistant face shield or goggles
- Pyrethrum/Pyrethrins – baseline plus rubber boots, and/or aprons (if livestock application)

RECOMMENDED ENVIRONMENTAL ACTION

RECOMMENDED ENVIRONMENTAL THRESHOLD DETERMINATIONS

A Negative Determination with Conditions was recommended in the original IEE that covered SEGLI/PEG SCS for activities that are related to pesticide training, promotion, distribution and use, directly or through other financial instruments (credit, sub grants, vouchers) under this amendment pursuant to 22 CFR 216.3(a)(2)(iii).

Recommended PERSUAP Conditions and Mitigation Actions

1. The 2014 Somalia PERSUAP addresses the needs of PEG SCS Program activities that will or may involve potential financing or use of pesticides, following 22CFR 216.3 (b) Pesticide Procedures. This PERSUAP addresses the following key findings and recommendations:

- **PERSUAP/Allowed Pesticides:** This 2014 USAID/Somalia PEG SCS Economic Growth and Agriculture Sector PERSUAP evaluates pesticides that could be potentially supported (used on demo trials, promoted during training, assistance to obtain financing to purchase, or direct procurement) with project and partner resources, as well as those that cannot be supported, including justifications.
- **Safety Training/Equipment:** Recommend that USAID-funded PEG SCS program activities that support the use of pesticides on demo trials, promote the use of pesticides to farmers, or procure pesticides for farmers perform pesticide safety training and procure/subsidize and use PPE.
- **Good Agriculture Practices:** Recommend that PEG SCS implementation staff, as well as subcontracted staff, promote the use of state of the art Good Agriculture Practices (GAPs) for each of their target crops, including use of high yielding and quality seed, soil fertility testing and conservation, plant nutritional/fertilizer needs to grow healthy crops, proper water use, crop rotation, clean storage and marketing.
- **Pest Management Plans/Integrated Pest Management:** Recommend that PEG SCS and its subcontractors promote the use of state of the art (used by many international, national and state extension services) pest management plans (PMPs, see Annex 2) containing major pests/diseases/weeds of each target crop, with preventive non-chemical IPM tools/tactics, available synthetic pesticides, as well as any artisanal and available natural pesticides available.
- **Spray Services:** Recommend that PEG SCS and any subcontractors promote and support the concept and use of pesticide spray services that have well-trained and PPE-protected spray personnel.

Primary Results of Analyses of Requested/Available Pesticides

Upon approval of this PERSUAP, the pesticide active ingredients (AIs) listed as “allowed” in the following table—and ONLY those AIs—may be supported by the PEG project and their sub-grantee SATG. Such support is subject to the safe use conditions summarized below and set out in detail in the SUAP, section 4 of this PERSUAP.

Synthesizing across the PER analysis, ONLY the below-listed pesticide AIs—and with the implementation of specific noted conditions—are permitted for use/support on the PEG project and by their sub-grantee SATG.

Insecticide AIs in commercial and artisanal products available in South-Central Somalia, and recommended by this PERSUAP for BEO approval for use in The PEG project, with condition that *label instructions* be followed

- azadirachtin (Neem tree, *Azadirachta indica* seed extract)
- carbaryl
- capsaicin (chili pepper, *Capsicum oleoresin*, extract)
- diatomaceous earth (mineral extract)
- garlic (*Allium sativum* oil extract)
- malathion
- permethrin
- pirimiphos-methyl
- pyrethrum (Chrysanthemum, *Tanacetum cinerariifolium* flower extract)

Insecticide AIs in products available in South-Central Somalia, and recommended by this PERSUAP for BEO approval for use in The PEG project (*with specific conditions*)

- acetamiprid (recommended for use during vegetative growth, not during flowering to protect foraging honeybees)
- beta-cyfluthrin (use formulations 10% and below)
- cypermethrin (use only permitted on livestock and for stored grain crack and crevice treatment, *not field horticulture*)
- deltamethrin (for all uses except on cotton)
- imidacloprid (recommended for use during vegetative growth, not during flowering to protect foraging honeybees)

Acaricide (for ticks) and miticide AIs in commercial and artisanal products available in South-Central Somalia, and recommended by this PERSUAP for BEO approval for use in The PEG project, with condition that *label instructions* be followed

- amitraz (only for ticks on livestock)
- capsaicin (chili pepper, *Capsicum oleoresin*, extract)
- pyrethrum (flower extract)
- sulfur (natural product)

Acaricide and miticide AIs in products available in South-Central Somalia, and recommended by this PERSUAP for BEO approval for use in The PEG project (*with specific conditions*)

- beta-cyfluthrin (use formulations 10% and below, as livestock ear tag)
- cypermethrin (use only permitted on livestock and for stored grain crack & crevice treatment, *not field horticulture*)
- deltamethrin (for all uses except on cotton)

Fungicide AIs in products available in South-Central Somalia, and recommended by this PERSUAP for BEO approval for use in The PEG project, with condition that *label instructions* be followed

- copper oxychloride (natural product, use only Class II and III products, not Class I, and use eye protection)
- potassium bicarbonate (natural product)
- sulfur (natural product)

Fungicide AIs in products available in South-Central Somalia, and recommended by

this PERSUAP for BEO approval for use in The PEG project (*with specific conditions*)

- chlorothalonil (use only Class II and III products of less than 50% concentration, not Class I, and use eye protection)

Herbicide AIs in products available in South-Central Somalia and recommended by this PERSUAP for BEO approval for use in The PEG project, with condition that *label instructions* be followed

- glyphosate
- glyphosate, isopropylamine salt

INTRODUCTION

This section introduces the purpose, scope, compliance context and methodology.

1.1 Purpose, Scope & Orientation

Purpose

To maintain compliance with USAID's Pesticide Procedures (22 CFR 216.3(b)), this 2014 Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) for DAI's PEG Project and (potentially) other near-future (2014/2015) USAID/Somalia Projects:

- **Establishes the pesticides available in South-Central Somalia for which support is authorized for 'use'** (see below) on the PEG project agriculture sector and value chain projects and activities.
- **Establishes requirements associated with support for these pesticides to** assure that pesticide use/support (1) per USAID policy, is within an IPM framework and (2) embodies the principles of safe pesticide use.

These requirements come into effect upon approval of the PERSUAP.

Scope

This 2014 Somalia PERSUAP document covers the PEG project in South-Central Somalia, and their sub-grantee SATG, partners, financiers and beneficiaries.

Orientation

The set of authorized pesticides and requirements for safe use are established through Section 3 of the document, the Pesticide Evaluation Report (PER), which assesses the 12 pesticide risk evaluation factors (a through l) required by 22 CFR 216.3(b).

The Safe Use Action Plan (SUAP) in Section 4 provides a succinct, stand-alone statement of compliance recommendations for pesticides, risk reduction, synthesized from the 12-factor analysis.

1.2 Regulatory Requirements, the PERSUAP concept, and Analytical Approach

According to Regulation 216, all USAID activities are subject to analysis and evaluation via – at minimum – an Initial Environmental Examination (IEE), and – at maximum – an Environmental Assessment (EA). USAID/Somalia produced an IEE to cover all economic growth projects and activities, and that recommends a PERSUAP be produced. This 2014 Somalia PERSUAP responds to that recommendation, and is the first PERSUAP ever written for Somalia.

A large part of Regulation 216 – part 216.3 – is devoted to pesticide use and safety. Part 216.3 requires that if USAID is to provide support for pesticides in a project, 12 pesticide factors must be analyzed and recommendations must be written to mitigate or reduce risks to human health and environmental resources. This plan must be followed up with appropriate training, monitoring and reporting for continuous improvement on risk reduction. The adoption of international best practices for crop production, protection and pesticide use safety is strongly encouraged.

Pesticide Definition

For the purposes of this PERSUAP, the word *pesticide* is used, following EPA's guidelines¹, for the following: fumigants, insecticides, miticides/acaricides, nematocides, molluscicides, fungicides, antimicrobials, bactericides/biocides, microbicides/antibiotics, herbicides, rodenticides, avicides, algicides, ovicides (kill eggs), disinfectants/sanitizers and anti-fouling agents. Even biological agents such as biopesticides, microbial pesticides, repellents, attractants/pheromones, defoliant, dessicants and insect growth regulators are included as pesticides.

USAID “Support for Pesticide Use”

“Support for pesticide use” by the PEG project, sub-grantee SATG and financing partners was defined and agreed upon at the outset of this PERSUAP study as potentially including:

- Support for promotion or use during training of farmers by the PEG project or its sub-grantee SATG.
- Use or support by the PEG project, sub-grantee SATG, partners or farmers on demonstration farms.
- Purchase directly by the PEG project, or indirectly through the project's sub-grantee SATG or financing mechanisms.

Pesticides *rejected* by this PERSUAP analysis cannot be ‘supported or used’ for any of the above PEG project activities, unless an EA is performed. See Section 4.1 for the rejected pesticides.

USAID Policy: Integrated Pest Management

In addition, since the early 1990s USAID has been committed to the philosophy and practice of Integrated Pest Management (IPM) as official policy. There is not a single standard international definition for IPM, but there is wide agreement on its basic elements. Under IPM:

- “First line” defenses against pest damage are a combination of non-chemical techniques such as biological control, habitat manipulation, use of predictive pest and disease monitoring tools like sticky and pheromone traps and micro meteorological stations linked to degree day and rainfall models, modification of cultural practices, and use of resistant varieties.
- Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism.
- Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment.

IPM is strongly promoted as part of Regulation 216.3 Factor C.

The PERSUAP

USAID Africa Bureau has adopted the PERSUAP, which formally constitutes an amendment to a project's IEE, to address the requirements of 22 CFR 216.3(b) with particular emphasis on assuring that pesticide use occurs within an IPM framework. A PERSUAP consists of two

¹ <http://www.epa.gov/pesticides/about/types.htm>

core parts, a “PER” and a “SUAP.” The PER first characterizes pest management needs for the subject USAID projects, and pesticides availability, pesticides awareness among potential beneficiaries, and the critical local context. This information then provides input to the assessment of the 12 pesticide risk evaluation factors (a through l) required by 22 CFR 216.3(b). The PER thereby establishes the set of authorized pesticides and requirements for safer use.

The Safer Use Action Plan (Section 6 of this document) provides a succinct, stand-alone statement of compliance requirements, synthesized from the PER 12-factor analysis in section 4. It also provides a template for assigning responsibilities and timelines for implementation of these requirements. The PEG SCS Project, subject to findings in this PERSUAP, must complete this SUAP template (as well as an Environmental Mitigation and Monitoring Plan—EMMP to be amended to contain IPM and SPU and risks and risk mitigation measures) and submit to its AOR/COR.

1.5 Somalia PEG Project Agriculture Sector PERSUAP Methodology

In and around Mogadishu, local Somali agriculture expert Dr. Hared Nur from Hargeisa visited farmers, herders, bazaars and weekly markets, as well as agriculture input stores to collect information on the agriculture and inputs sectors. He also visited Somali government officials and used questionnaires developed by international consultant Alan Schroeder to collect information on common pests and diseases of South-Central Somali livestock and crops, as well as specific information on IPM and GAPs, including pesticides. The questionnaire also addressed the 12 factors of Regulation 216.3.

This study was completed from late July to early September of 2014, during the second dry season, the *Xagaa* (pronounced "Hagaa") and just before the *Dayr*, which is the shortest rainy season, lasting from October to December.

The complexity of the tasks needed for this study required that the consultants provide accurate interpretation of 22 CFR 216.3 as well as cutting-edge knowledge of GAP, IPM, agronomic, entomological, phytopathological, rodentological, weed, agribusiness and chemical topics. This PERSUAP study chose pesticide active ingredients (instead of product names) as the common denominator for analysis.

This PERSUAP contains as many links to websites with agriculture and pesticide best practices as possible, both to make it easier to use (reduce the report’s length) and more up-to-date or accurate (as websites are updated continually, but static information is not). So, instead of having numerous annexes containing pesticide safety equipment recommendations or safe pesticide use practices, hot-linked websites now take their place. However, if PEG-supported project participants do not have access to the Internet, the projects should reproduce and distribute key updated information in written form.

BACKGROUND

2.1 Somalia Country Background²

² http://en.wikipedia.org/wiki/Geography_of_Somalia;
http://en.wikipedia.org/wiki/Agriculture_in_Somalia

This section introduces Somalia and its resources to provide a context for the agricultural systems in the various regions. Somalia is located on the Horn of Africa (see Figure 1). It is bordered by Ethiopia to the west, Djibouti to the northwest, and Kenya to the southwest. On the north, it is bordered by the Gulf of Aden, with the Indian Ocean to the east. With a land area of 637,540 square kilometers, Somalia's terrain consists mainly of plateaus, plans and highlands. Its coastline is more than 3,025 kilometers in length, the longest of mainland Africa and the Middle East. In the far north, Figure 2, the topography of Somalia shows the rugged east-west ranges of the Ogo Mountains that lie along the Gulf of Aden coast.



Figure 1: Somalia Map

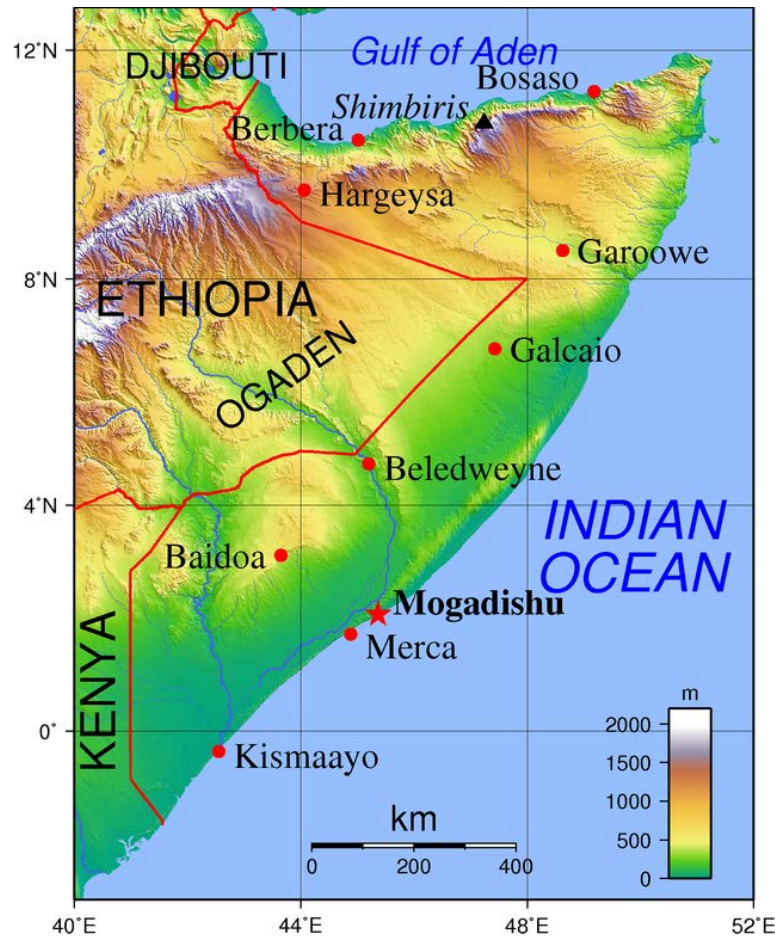


Figure 2: Somalia Topography

Somalia Agriculture

From 46 to 56 percent of Somalia's land area can be considered permanent pasture. About 14 percent is classified as forest. And, approximately 13 percent is suitable for cultivation, but most of that area requires additional investments in wells and roads for it to be usable.

Somalia's economy consists of both traditional and modern production, with a gradual shift in favor of modern industrial techniques taking root. Agriculture is the most important economic sector. It accounts for about 65% of the GDP and employs 65% of the workforce. Livestock alone contributes about 40% to GDP and more than 50% of export earnings. About 80% of the population is composed of nomadic or semi-nomadic pastoralists who keep camels, goats, sheep and cattle, especially in the more arid north. The herders also gather tree and bush resins and gums like Frankencense to supplement their income.

Somalia's farming areas are concentrated in the southern part of the country. The Juba and Shabelle Rivers pass through the south, rendering the soil more conducive to crop cultivation than the comparatively arid north, where pastoralism has instead traditionally been practiced. The principal commercial export crop is bananas. Sugarcane, sorghum and maize are also produced in scale for the domestic market.

Somalia Soils³

In the highlands around Hargeysa, relatively high rainfall has raised the organic content in the sandy calcareous soils characteristic of the northern plains, and this soil has supported some dry farming. South of Hargeysa begins the Haud, with red calcareous soils that continue into the Ethiopian Ogaden. This soil supports vegetation ideal for camel and goat grazing. To the east of the Haud is the Mudug Plain, leading to the Indian Ocean coast; this region, too, supports a pastoral economy. The area between the Jubba and Shabeelle rivers has soils varying from reddish to dark clays, with some alluvial deposits and fine black soil. This is the area of plantation agriculture and subsistence agropastoralism.

Somalia Land Use for Agriculture

Figure 3, below, shows the density of livestock per square kilometer, with high densities in the south and some patches near the Ethiopian border in the more arid north. Figure 4, on the other hand, shows the land use covered by crops, again, particularly in the south especially along the two rivers. In addition to the PEG project target crops listed in the Executive Summary, the following are also produced in Somalia: sesame, cassava, sorghum, millets, rice, beans, cucumber, garlic, eggplant, pumpkins/squashes and groundnut. Fruits include dates, banana, papaya, mango, citrus and guava. Spices and Gums/Resins include: sesame, frankincense, coriander/cilantro and parsley.

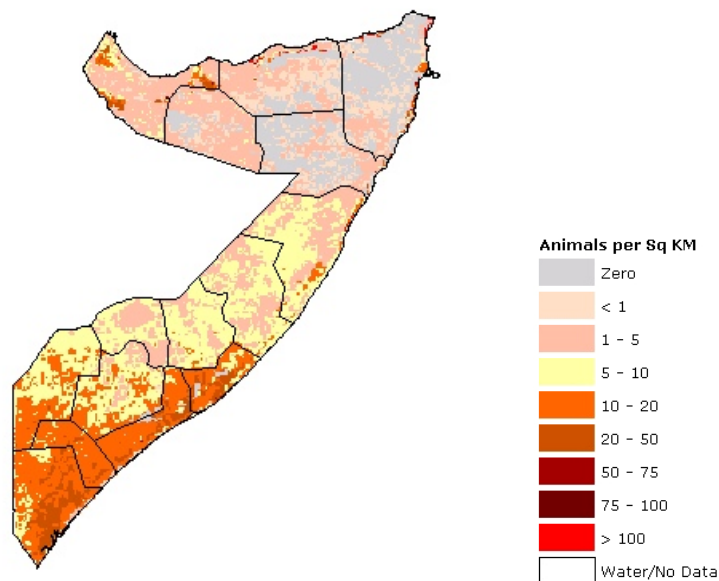


Figure 3: Livestock-Bovines Density in Somalia⁴

³ <http://countrystudies.us/somalia/62.htm>

⁴ http://www.catg.org/cheetah/07_map-centre/7_4_North-African-region/thematic-maps/thematic-maps.htm

Most of Somalia is shrubland (shown in olive green below), perfect for camel and goat grazing.

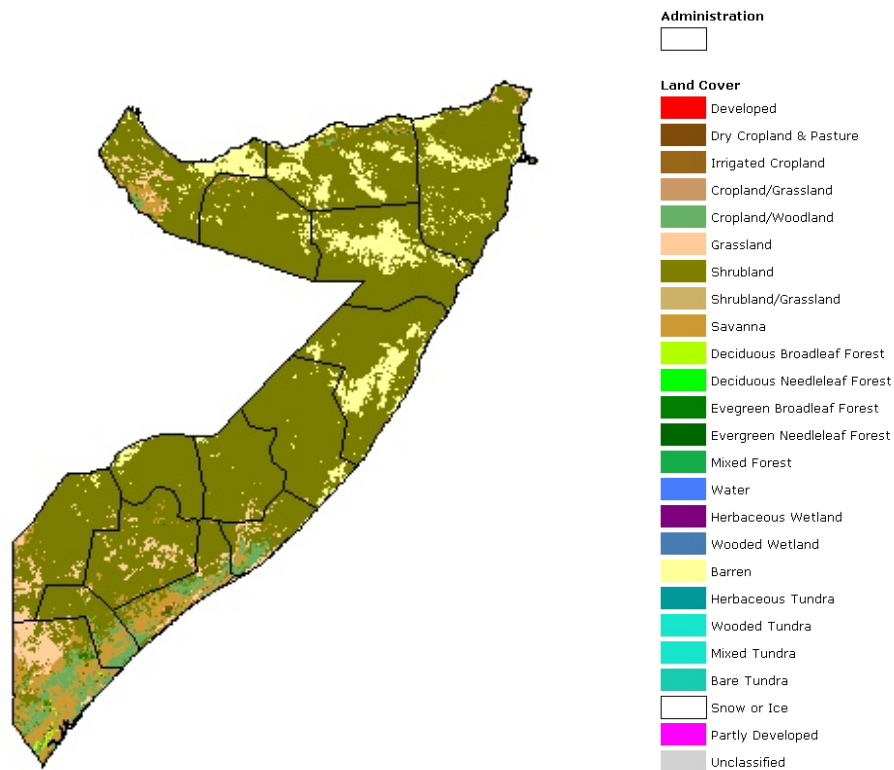


Figure 4: Land Cover and Use in Somalia⁵

Somalia Climate and Rainfall

Unlike the climates of most other countries at this latitude, conditions in Somalia range from arid in the northeastern and central regions to semiarid in the northwest and south. In the northeast, annual rainfall is less than 100 mm; in the central plateaus, it is about 200 to 300 mm. The northwestern and southwestern parts of the nation, however, receive considerably more rain, with an average of 510 to 610 mm falling per year. Although the coastal regions are hot and humid throughout the year, the hinterland is typically dry and hot.

Due to Somalia's proximity to the equator, there is not much seasonal variation in its climate. However, very unpredictable rainfalls occur at times. Hot conditions prevail year-round along with monsoon winds and irregular rainfall. Mean daily maximum temperatures range from 30 to 40 °C, except at higher elevations and along the eastern seaboard, where the effects of a cold offshore current can moderate temperatures.

Figure 5, below, shows average annual rainfall data for Somalia. Clearly, the southern part of the country receives more rainfall than the north, with the tip of the Horn receiving almost

⁵ http://www.catsg.org/cheetah/07_map-centre/7_4_North-African-region/thematic-maps/thematic-maps.htm

none. Not only does the South-Central region benefit from higher rainfall, it also benefits from the presence of two major rivers, and is quite green much of the year and especially during the two rainy seasons.

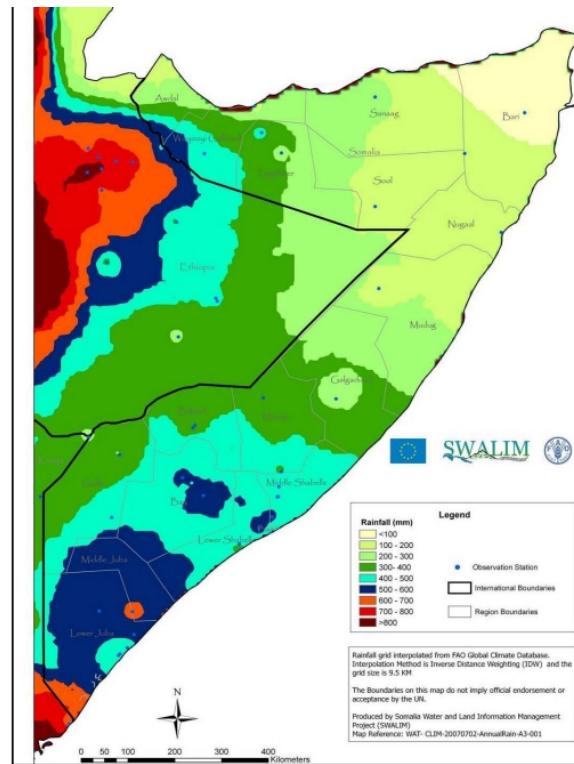


Figure 4: Mean annual rainfall distribution in Somalia

Figure 5: Somalia Annual Average Rainfall Distribution⁶

2.2 PEG Project Background

The PEG project funded by USAID-East Africa combines private sector and value chain development to improve competitiveness and support economic growth in Somaliland. The purpose is to help local authorities and private sector groups improve the enabling environment for investment, generate more productive employment and improve other livelihood activities, operating mostly in northern Somalia and possibly in south and central regions, avoiding those areas impacted by insecurity.

This is the first development initiative targeting economic growth for the USAID/East Africa/Limited Presence Countries Somalia program, and is partially funded with Department of Defense 1207 funds transfer. Using a flexible approach that relies on detailed analysis before launching sub-activities, the Partnership will focus on two areas: overall private sector development, including women's business development, and strengthening specific productive value chains, including livestock and fisheries. Sub-activities are being selected through a participatory assessment and design process during the first quarters of the program, and may include private sector development and value chain development.

⁶ <http://www.somalinet.com/forums/viewtopic.php?t=341346&p=4168064>

The two main aspects of the Partnership at this time are private sector development and value chain development. Planned activities in each area include:

Private sector development:

- Facilitate public private partnerships, especially for service delivery;
- Build the capacity of entrepreneurs and business groups through business skills development;
- Increase access to business development services;
- Increase access of women entrepreneurs to micro-finance programs, commercial credit and women's business associations;
- Pilot alternative energy sources that are less polluting, commercially sustainable and reliable so as to support the energy needs of industrial development;
- Help local authorities and private sector groups create public awareness of the benefits of such activities and the potential for further improvements.

Value chain development:

- Build capacity for veterinary associations and animal health workers to protect the livestock trade;
- Facilitate knowledge networking among trade and commercial associations and pastoral networks;
- Strengthen livestock market information systems;
- Support community-based, conflict sensitive natural resource management and improved rangeland management, where possible
- Support fishing communities by helping build their capacity for processing and preservation
- Help local authorities and private sector groups create public awareness of the benefits of such activities and the potential for further improvements.

2.3 Somalia Pesticide Sector Risks Identified by the PERSUAP Study

The following table identifies risks found in the agriculture value chain and pesticide sectors in Somalia, as identified by Dr. Schroeder from internet searches and experienced by Dr. Nur as he visited government offices, NGOs, pesticide stores and farmers.

Problems, constraints or risks in the Somalia pesticide sector

There are no pesticide regulations existing yet for Somalia
 There is no official registration of pesticides for import and use in Somalia
 There are no soil, plant, water and pesticide testing laboratories in Somalia
 Quantities of obsolete pesticides, including POPs and PIC chemicals, potentially existing in Somalia are not known since donors have not been able to work in Somalia the past 20 years
 Funds for monitoring pesticides and residues are non-existent
 Many past government storage facilities have been raided and pesticides stolen and used without proper knowledge on which chemicals to use on which pests and diseases
 There is high insecurity in prime growing areas and limited resources for extension services and pesticide enforcement

Many of the pesticides entering Somalia are too toxic for smallholder farmers to use
 A very small percentage of pesticides entering Somalia are from brand-name companies with relatively higher standards for quality (see Annex 10)
 Pesticides have recently and in the past poisoned some farmers and farm family members
 There is a lack of pesticide human and environmental toxicity awareness by farmers

There are limited farmer abilities to identify (ID) crop and livestock pests and diseases, especially for small and microscopic pests and diseases

Many farmers do not know and employ IPM tools and tactics for preventing pests and diseases

Many farmers do not understand proper sprayer calibration, leading to over- and under-applications of pesticides

Illiterate farmers cannot read pesticide labels written in Arabic, English or other languages

Many farmers apply the wrong pesticide for given pests and diseases

There is no IPM guidance available to extension agents and farmers

Pesticide shops with no or very limited safety equipment (PPE) on hand

Pesticides are often subdivided into small containers, like empty water bottles, and sold

There is pesticide mixing with bare hands and little use of PPE by pesticide applicators

Pesticides are often applied at wrong time of day, with rain and with winds too high

Old, poorly maintained back-pack sprayers leak onto people who use them

Proper disposal of unused pesticides & empty containers is lacking

On the positive side, the following observations were also made, which show a level of safety found in Somalia concerning the pesticide value chain:

- In comparison with surrounding countries, few generic Chinese and Indian pesticides of questionable quality enter Somalia as a percent of the total.
- Some Somali farmers use preventive IPM tools and tactics, which ultimately reduce the pest populations and the amount of chemicals required.
- It is likely that few obsolete POP and PIC chemicals remain in old government warehouses awaiting expensive inventory, repackaging and disposal.

SECTION 3: PESTICIDE EVALUATION REPORT (PER), PART 1: PEST MANAGEMENT NEEDS, PESTICIDES AVAILABLE, AND MANAGEMENT CAPACITY

3.1 Pest Management Needs for Target Crops/Livestock

The target crops and livestock are already listed above, under the Executive Summary, and again in Annex 1. As noted in Section 2.3 above, Annex 1, as well as in the PER below, the specific and detailed—in most cases precisely to pest/disease genus and species—preventive and curative pest management needs for each of the target crops listed in Annex 1. Please see Annex 1 for the IPM needs. These tools can be used by the project—along with the information contained in Annexes 2 and 3—to make hard-copy seasonal and crop-specific, crop and/or pest management plans (CMPs or PMPs) for crop-growing or livestock-raising field project managers as well as beneficiary farmers to use to manage their production.

Beyond these needs, as analyzed and detailed above, under part 2.3, and below, under Part 2 of this PER, IPM and SPU training is needed by both project field activity managers as well as targeted beneficiary farmers. To begin with, there are limited farmer abilities to more precisely identify (ID) crop and livestock pests and diseases, especially the very small and microscopic pests and diseases. Many farmers do not know and employ a sufficient number of IPM tools and tactics for preventing pests and diseases. And, there is no IPM guidance available to extension agents and farmers.

As noted above, under Section 2.3: There are no pesticide regulations existing yet for Somalia and there is no official registration of pesticides for import and use in Somalia. Furthermore, there are no soil, plant, water and pesticide testing laboratories in Somalia. Quantities of obsolete pesticides, including POPs and PIC chemicals, potentially existing in Somalia are not known since donors have not been able to work in Somalia the past 20 years. Somalia mechanisms and funds for monitoring pesticides and residues are non-existent, and there is high insecurity in prime growing areas and limited resources for extension services and pesticide enforcement.

Many past Somali government storage facilities have been raided and pesticides stolen and used, without needed precision at properly identifying pests and diseases for which each was to be used.

3.2 Traditional pest control practices and Current State of IPM Awareness and Practice

As noted below, under PER Factors c and i, some Somali farmers use the following GAP and preventive IPM tools like: Pest resistant/tolerant seed (if they can get it from some source); seed treatment with pesticides; use of organic fertilizers (they use animal manure for vegetables); use of purchased mineral fertilizers (rarely urea); crop rotation (they rotate cereals with legumes); home made plant and mineral extracts (see Annex 10), and hand hoeing is used for weed control.

For livestock, farmers use hand-picking of ticks, hand wiping pesticides onto their livestock with a rag, vaccines when they can get them for disease prevention, use natural saltpan dips and rub on local aromatic plants to repel biting flies and ticks. Most farmers integrate different preventive tools and tactics, and some chemicals, without knowing that this approach is called IPM.

In the past, and continuing today, commercial farmers growing crops on alluvial soils along the major rivers have had more resources and are clearly more advanced than the majority of smallholder farmers and pastoralists. As noted above, under Section 2.3, many smallholder farmers do not know about or employ many modern IPM tools and tactics for preventing pests and diseases, like plastic mulches, pheromone traps and resistant varieties, among others. Furthermore, there is no IPM guidance available through extension agents to farmers.

3.3 Current Pesticide Use/Availability

As found in Annex 10, in addition to 8 homemade or ‘natural’ pesticide active ingredients (allicin (garlic extract); azadirachtin (neem seed extract); capsaicin (chili pepper, *Capsicum oleoresin*, extract); diatomaceous earth (mineral extract); pyrethrum (flower extract); copper oxychloride (natural product); potassium bicarbonate (natural product) and sulfur (natural product)), this study found only 20 different insecticide AIs, 8 acaricide/miticide AIs, 2 fungicide AIs and 2 herbicide AIs. The number of pesticides, as well as the number of pesticide AIs to choose from, is highly limited, when compared with neighboring countries Ethiopia and Kenya.

Medium and large-scale farmers operating on alluvial soils along the major rivers source and buy their own pesticides directly from importers/wholesalers, or through informal cross-border trade with neighboring countries. A small proportion of smallholder farmers buys and uses pesticides. Many of these are purchased in local ‘table-top’ bazaars, village market days, or very small retailers. Pastoralists, if they buy acaricides to control tick vectors of serious diseases, do so through local retailers, or if very small-scale, through bazaars and weekly market days. Many larger-scale pastoralists move across borders with Kenya and Ethiopia to graze their animals, and buy acaricides in these countries.

3.4 Available PPE and Application Equipment

As noted under PER Factor d, below, Somali pastoralists and horticulturalists cannot generally get and do not generally use PPE. Thus, the PEG project will be required to provide full PPE for its agronomists to use for spraying on demonstration trials and at farmer field days, and PEG will be required to provide such PPE for project-supported farmers and pastoralists, or their cooperatives for member sharing. Furthermore, Factor d notes that most Somali farmers use hand-pumped knapsack sprayers and hand-placed granular formulations for horticulture. Pesticides are applied to livestock by hand-rag application and pour-on applications.

Baseline PPE must be used for application of all pesticides and consists of chemical resistant rubber gloves, long-sleeved shirt, long pants, and shoes plus socks, all of which are washed and dried at the end of each day’s spraying. For pesticides that are listed as acute toxicity class/category II, additional PPE is generally found listed or pictogrammed on the product label as required, and is listed below as follows:

- Amitraz – baseline plus rubber boots, and/or aprons (if livestock application)
- Carbaryl – baseline plus rubber boots, and/or aprons (if livestock application)
- Chlorothalonil – baseline plus chemical-resistant face shield or goggles
- Copper oxychloride – baseline chemical-resistant face shield or goggles (acute toxicity class/category II or III)
- Beta-Cyfluthrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Cypermethrin – baseline plus rubber boots, and/or aprons (if livestock application)

- Deltamethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Imidacloprid – baseline plus boots
- Malathion – baseline plus rubber boots, and/or aprons (if livestock application)
- Permethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Pirimiphos-methyl – baseline plus chemical-resistant face shield or goggles
- Pyrethrum/Pyrethrins – baseline plus rubber boots, and/or aprons (if livestock application)

3.5 Pesticides Knowledge and Awareness

Pesticides have recently and in the past poisoned some farmers and farm family members, so there is a lack of pesticide human and environmental toxicity awareness by farmers. There are limited farmer abilities to identify (ID) crop and livestock pests and diseases, especially for small and microscopic pests and diseases. Many farmers do not know and employ some modern IPM tools and tactics for preventing pests and diseases. And many farmers do not understand proper sprayer calibration, leading to over- and under-applications of pesticides. Furthermore, farmers cannot read pesticide labels written in Arabic, English or other languages. Finally, many farmers apply the wrong pesticide for given pests and diseases.

Under PER Factor f, below, we see that farmers are not aware of the development of pest resistance to pesticides.

3.6 Agro-Dealer Safer Use Awareness and Extension to Customers

As noted above, under Section 2.3, pesticides are often subdivided into small containers, like empty water bottles, and sold. Most of the retailer clerks do not have a background in agronomy.

3.7 List of Candidate Pesticides

The list of candidate pesticides has already been provided, below, as Annex 10.

SECTION 4: PER, PART 2: THE 12-FACTOR ANALYSIS

This part of the PERSUAP, the PER (Pesticide Evaluation Report), addresses pesticide choices based upon environmental and human health issues, uses, alternate options, IPM, biodiversity, conservation, training, PPE options, monitoring and mitigation recommendations according to the twelve Regulation 216.3(b)(1) Pesticide Procedures Factors, outlined and analyzed below.

Reg. 216.3(b)(1)(i) stipulates: “When a project includes assistance for procurement or use, or both, of pesticides registered for the same or similar uses by USEPA without restriction, the Initial Environmental Examination for the project shall include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticide use to determine whether the use may result in significant environmental impact. Factors to be considered in such an evaluation shall include, but not be limited to the following:” (see box, right)

In Annex 1, this PERSUAP proposes preventive IPM tools and tactics available to be integrated with the pesticides evaluated by this PER. Annexes 2 and 3 provide guidelines for making PMPs and implementing IPM.

It would be ideal to find pesticides for every need that are EPA Class IV acute toxicity, have no chronic human health issues, no water pollution issues and no ecotoxicity issues. Such pesticides do not exist. Most pesticides, including “natural” pesticides, have toxicity to at least one aquatic organism, or bees, or birds. And, since “the dose makes the poison” as Paracelsus the Renaissance Alchemist and founder of toxicology expressed, even the most benign chemical can be toxic or fatal in a sufficiently high concentration.

THE 12 PESTICIDE FACTORS

Factor A. *USEPA Registration Status of the Proposed Pesticides*

Factor B. *Basis for Selection of Pesticides*

Factor C. *Extent to which the proposed pesticide use is, or could be, part of an IPM program*

Factor D. *Proposed method or methods of application, including the availability of application and safety equipment*

Factor E. *Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards*

Factor F. *Effectiveness of the requested pesticide for the proposed use*

Factor G. *Compatibility of the proposed pesticide use with target and non-target ecosystems*

Factor H. *Conditions under which the pesticide is to be used, including climate, geography, hydrology, and soils*

Factor I. *Availability of other pesticides or non-chemical control methods*

Factor J. *Host country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide*

Factor K. *Provision for training of users and applicators.*

Factor L. *Provision made for monitoring the use and effectiveness of each pesticide*

4.1 Factor A: USEPA Registration Status of the Proposed Pesticides

USAID project activities are effectively limited to promoting during training, recommending, buying, subsidizing, financing or permitting on demonstration farms, pesticides containing active ingredients (AIs) in products registered in the US by the EPA for the same or *similar* uses, without restriction. Emphasis is placed on “similar uses” because often the crops and

their pest species found overseas are not present in the US, and therefore pesticides may not be registered for the exact same use, but often are registered for similar crops, the same Genera of pests, methods of application, and pest situations.

The USEPA classifies pesticides according to actual toxicity of the formulated products, taking formulation types and concentrations into account, thus generally making the formulated product less toxic than the active ingredients alone would be. This method of classifying acute toxicity is accurate and representative of actual risks encountered in the field. By contrast, the WHO acute toxicity classification system is based on the active ingredient only. For a comparison of USEPA and WHO acute toxicity classification systems, see Annex 4.

In the USA, some specific commercial pesticide products are labeled as Restricted Use Pesticides (RUPs) due to inordinate risks, usually under specific circumstances of use, such as formulation or crop. However, for each AI, which may be present in a number of RUP products, there are generally additional or other products, formulations and uses—with the exact same AI—that do not pose the same risks and are thus labeled or determined to be General Use Pesticides (GUP)—that is—not a RUP. Ergo, for each AI, there may be products classified as RUP and non-RUP depending upon risks they do or do not pose.

Pesticide registration is not yet done in Somalia as there are insufficient funds and other priorities are bearing down on the MOA and MOLW. This study took the next best option and analyzed those pesticides found available in the project area as well as those requested by PEG or SATG. The available pesticides that were analyzed for this PERSUAP are contained in Annex 10.

Websites used by this PERSUAP study for researching pesticide Active Ingredients and Commercial Products are: <http://www.pesticideinfo.org> (linked to USEPA websites on registration, restriction and ecotoxicity); and <http://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm> (a website with good ecotoxicological information, among a plethora of other physical and chemical information on each pesticide AI).

Analysis: Annex 5 provides EPA registration status analysis for each AI found in selected pesticides currently desired by PEG and its subgrantee, imported, available and used in Somalia. Annex 5, column number three, labeled “EPA Registered” has a “yes” if the AI is registered by EPA in pesticides for same or similar uses. If column three has a “no” (or “no hort”) meaning it is not registered by EPA (or not registered for horticultural uses) and is thus one reason for shading the AI line with red—signifying that it is not approved in the PERSUAP Annex 5 analysis. Pesticide AIs that pass this registration factor, and all subsequent factor analyses, are shaded with green. The remaining pesticides shaded in yellow highlight have certain specific conditions (or cautions) for use.

This PERSUAP evaluates all the active ingredients contained in pesticides analyzed by this PERSUAP. The following pesticide AIs, grouped by type, did not pass this Factor A analysis and are listed with the reason they did not pass, and pesticide products containing them should not be supported by the Somalia PEG project or subgrantees (i.e., they are rejected in this PERSUAP):

Insecticide AIs in products available in Somalia, and recommended by this PERSUAP for BEO rejection for use in The PEG project (*with reason for rejection*)

- alpha-cypermethrin (RUP)
- aluminum phosphide (RUP)

- carbofuran (RUP)
- carbosulfan (not EPA registered)
- chlorpyrifos-ethyl (not registered for horticultural use)
- cyfluthrin (all horticultural uses are RUP)
- cypermethrin (not registered for horticultural use, but registered and allowed by this PERSUAP for veterinary use and spraying grain storage facilities)
- diazinon (all horticulture uses are RUP)
- dichlorvos/DDVP (not registered for horticultural use)
- fenvalerate (not EPA registered)
- methomyl (all horticulture uses are RUP)
- triazophos (not EPA registered)

Acaricide AIs in products available in Somalia, and recommended by this PERSUAP for BEO rejection for use in The PEG project (*with reason for rejection*)

- alpha-cypermethrin (RUP)
- chlorfenvinphos
- fenvalerate (not EPA registered)
- triazophos (not EPA registered)

Fungicide AIs in products available in Somalia, and recommended by this PERSUAP for BEO rejection for use in The PEG project (*with reason for rejection*)

- hexaconazole (not EPA registered)

Pesticide AIs that passed this Factor A analysis and are thus recommended to the BEO for acceptance for use on the Somalia PEG funded programs are listed in Annex 5 and shaded green if they have no special conditions (other than for users to read and follow label instructions) and shaded in yellow if there are specific conditions for use. Such conditions for chemicals shaded yellow are highlighted above in the Executive Summary.

Compliance Requirements

- If PEG's (and SATG's) beneficiaries use pesticides on project-related activities, they must contain only pesticide AIs evaluated and approved (and listed in the Executive Summary) by this PERSUAP.
- If there is a choice, use products with lower human toxicity.

4.2 Factor B: Basis for Selection of Pesticides

Field visits found that farmers in Somalia choose pesticides based primarily upon the price, efficacy and availability of products in quantities they desire and can afford. They also use advice of agrodealers, extension agents and neighbors. Rarely do they choose pesticides based upon safety or environmental concerns.

Recommendations:

- The inputs markets in Somalia require expanding so more options are made available to farmers. Kenya's inputs registration, import and usage system is one of the best in

Africa; it could be used as a source of high quality expertise and products for cross-border trade, if Somalia begins to register products.

- Farmers require training on how to choose the correct pesticide based on the crop-pest combinations present, and training on the need to rotate pesticides from different classes to reduce the development of pest resistance.

4.3 Factor C: Extent to Which the Proposed Pesticide Use Is, Or Could Be, Part of an IPM Program

Some Somali farmers use the following GAP and preventive IPM tools like: Pest resistant/tolerant seed (if they can get it from some source); seed treatment with synthetic pesticides; use of organic fertilizers (they use animal manure for vegetables); use of purchased mineral fertilizers (rarely urea); crop rotation (they rotate cereals with legumes); plant and mineral extracts, and hand hoeing is used for weed control. For livestock, farmers use vaccines when they can get them, for disease prevention and use local aromatic plant extracts to repel biting flies and ticks.

Recommendations:

- Preventive IPM tools and tactics for each crop-pest combination should be used before and combined with the use of synthetic pesticides.
- Somalia needs a national Pest Management Plan (PMP) with preventive tools and tactics to help reduce pests of major crops.
- World Bank assists many countries to produce these PMPs, and could be requested, if desired. Annex 1 of this PERSUAP provides IPM information for most Somali livestock- and crop-pest/disease combinations. Annexes 2 and 3 provide guidelines for making PMPs and using IPM. Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.

4.4 Factor D: Proposed Method or Methods of Application, Including the Availability of Application and Safety Equipment

Most Somali farmers use hand-pumped knapsack sprayers and hand-placed granular formulations for horticulture. Pesticides are applied to livestock by hand-rag application and pour-on applications. No PPE is available in Somalia. Most farmers do not use PPE to apply pesticides and do not calibrate their sprayers properly, leading to over- and under-dosing. PEG project agronomists bought and use PPE for spraying and demonstrations.

Baseline PPE must be used for application of all pesticides and consists of chemical resistant rubber gloves, long-sleeved shirt, long pants, and shoes plus socks, all of which are washed and dried at the end of each day's spraying. For pesticides that are listed as acute toxicity class/category II, additional PPE is generally found listed or pictogrammed on the product label as required, and is listed below as follows:

- Amitraz – baseline plus rubber boots, and/or aprons (if livestock application)
- Carbaryl – baseline plus rubber boots, and/or aprons (if livestock application)
- Chlorothalonil – baseline plus chemical-resistant face shield or goggles
- Copper oxychloride – baseline chemical-resistant face shield or goggles (acute toxicity class/category II or III)

- Beta-Cyfluthrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Cypermethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Deltamethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Imidacloprid – baseline plus boots
- Malathion – baseline plus rubber boots, and/or aprons (if livestock application)
- Permethrin – baseline plus rubber boots, and/or aprons (if livestock application)
- Pirimiphos-methyl – baseline plus chemical-resistant face shield or goggles
- Pyrethrum/Pyrethrins – baseline plus rubber boots, and/or aprons (if livestock application)

Recommendations:

- Train farmers on proper use of PPE as well as sprayer calibration, use, maintenance and empty container disposal by rinsing, puncturing and burial.
- Promote the concept of spray service providers.

4.5 Factor E: Any Acute and Long-Term Toxicological Hazards, either Human or Environmental, Associated With the Proposed Use, And Measures Available To Minimize Such Hazards

There are some recent instances of Somali farmer poisonings from pesticides. Most farmers do not fully understand acute and chronic health issues associated with pesticide use.

Recommendations:

- Train farmers on how to read and understand pictograms on safety precautions and first aid measures on pesticide labels, and encourage them to use PPE.

4.6 Factor F: Effectiveness of the Requested Pesticide for the Proposed Use

The majority of the pesticides sold in Somalia are from Jordanian companies ChemVet, VetAgro and Vapco. A few pesticides contain generic versions of off-patent pesticide AIs, some of which may be of untested quality and come without proper agrodealer technical support. Pesticide resistance is less likely in South-Central Somalia due to past low availability, high cost and little use.

Pests and diseases known to have developed significant resistance to pesticides (especially to older-generation organophosphate, carbamate and synthetic pyrethroid insecticides, strobil fungicides and azine herbicides globally; see Annex 5 for classes in which each pesticide is categorized):

- Whiteflies
- Aphids
- Spider mites
- Thrips
- Mealybugs
- Scales
- Psyllids
- Colorado potato beetle

- Corn earworm
- Powdery mildew
- Downy mildew
- Pigweed
- Striga

Pesticides with known global resistance by certain pests or diseases (use with care—do careful calculations of dose—and rotate with other classes or families of pesticides):

- Most of the synthetic pyrethroid insecticides and miticides
- Strobil fungicides
- Glyphosate herbicide
- Azine herbicides

Issue: Lack of knowledge and information on reduced pesticide effectiveness and resistance. At some point, project field staff and farmers may begin to note that some products no longer work well to control pests in their field, and will likely begin to blame pesticide manufacturers for a weaker product. This could be due to the use of cheap generic products, improper dosing, or the development of resistance. Farmers should be trained to understand the development of resistance, and project implementers should be on the lookout for it during their field visits.

A resistance management strategy should also consider cross-resistance between pesticides with different modes/target sites of action. Pests may develop cross-resistance to pesticides based on mode/target site of action. The website <http://www.pesticideresistance.com/> can be used to search for known resistance issues in countries with certain pest or disease resistance to specific pesticide AIs.

If pesticide use is warranted and a risk of pesticide resistance development is identified, a **Resistance Risk Management** approach should be followed. The following section details points of concern for both application equipment and pesticide applications.

Ways to address and manage or mitigate pest resistance:

- **Use IPM to minimize pesticide use:** Minimizing pesticide use is fundamental to pesticide resistance management. IPM programs incorporating pest monitoring in USA states of California, New York, and Maryland, and in Canada have demonstrated 25 to 50% reduction in pesticide use with an increase in crop quality. IPM programs will help determine the best application timing for pesticides (when they will do the most good), thus helping to reduce the number of applications.

The use of nonchemical strategies, such as pest exclusion (e.g., screening, microtunnels, greenhouses), host-free periods, crop rotation, biological control, and weed control may reduce the need to use chemicals and consequently slow the development of pesticide resistance.

- **Avoid Knapsack Mixes:** Never combine two pesticides with the same mode of action in a tank mix (e.g., two organophosphate insecticides or two azine herbicides). Such a 'super dose' often increases the chances of selection for resistant individuals. In some cases, mixing pesticides from two different classes provides superior control. However, long-term use of these two-class pesticide mixes can also give rise to pesticide resistance,

if resistance mechanisms to both pesticides arise together in some individuals. Continued use of the mixture will select for these multiple-pesticide-resistant pests.

- **Avoid Persistent Chemicals:** Insects with resistant genes will be genetically selected over susceptible ones whenever insecticide concentrations kill only the susceptible pests. An ideal pesticide quickly disappears from the environment so that persistence of a 'selecting dose' does not occur. When persistent chemicals must be used, consider where they can be used in a rotation scheme to provide the control needed and with a minimum length of exposure.
- **Use Long-term Pesticide Rotations:** Resistance management strategies for insects, weeds, and fungal pathogens all include rotating classes of pesticides. Pesticides with the same modes of action have been assigned group numbers by their respective pesticide resistance action committees, Insecticide Resistance Action Committee (IRAC)⁷, Fungicide Resistance Action Committee (FRAC)⁸, and Herbicide Resistance Action Committee (HRAC)⁹. These group numbers have been included in the treatment tables of these committee's guidelines (see foot-noted websites, below) to help clarify which pesticides can be rotated.

However, the strategies used in rotations differ. For example, with fungicides, classes should be rotated every application. With insecticides, a single chemical class should be used for a single generation of the target pest followed by a rotation to a new class of insecticide that will affect the next generation and any survivors from the first generation. Longer use of a single chemical class will enhance the chance of resistance since the survivors of the first generation and the next will most likely be tolerant to that class. Rotating through many chemical classes in successive generations will help maintain efficacy.

Recommendations:

- Train and encourage farmers to value and buy higher quality products from name brand companies, and that come with technical support.
- Train and encourage farmers to rotate pesticides from different classes (modes of action) to reduce or slow resistance development.

4.7 Factor G: Compatibility of the Proposed Pesticide Use with Target and Non-Target Ecosystems

Non-target species of concern include wildlife, fish, honeybees, birds, earthworms, aquatic organisms and beneficial insects.

Biodiversity, protected areas and pesticides in Somalia

Annex 5 compiles the known risks to the different types of terrestrial and aquatic organisms referred to above for each pesticide active ingredient found in pesticide products available for use in Somalia or requested for use in Somalia, and covered by this PERSUAP, so that

⁷ <http://www.irac-online.org/>

⁸ <http://www.frac.info/>

⁹ <http://www.hracglobal.com/>

informed product choices can be made if a pesticide is to be used in or near sensitive areas or resources.

In 2005, USAID REDSO produced a Somalia Environmental Analysis¹⁰ on Tropical Forestry, Biodiversity & Environmental Management document.

Somalia's Protected Areas and Natural Resources

The 2005 Somalia Biodiversity and Forestry Study finds the unwise use of pesticides as one of the greatest threats to biodiversity in general as well as in Somalia. The report does not show any protected areas or species in Somalia. A Google search shows mammals of Somalia at this site: http://en.wikipedia.org/wiki/List_of_mammals_of_Somalia. The IUCN (International Union for Conservation of Nature) has classified Somalia's animals by its "Red List" criteria for endangered species. Using a 2004 version of this list another website¹¹ shows critically endangered, endangered and vulnerable species of mammals in Somalia.

Endangered plants, aquatic organisms, fish and birds of African in general and Somalia in particular are found by searching this website: <http://earthsendangered.com/search-regions3.asp?search=1&sgroup=allgroups&ID=307>.

Recommendations

- Train farmers about ecotoxicity and on how to read ecotoxicity precautions on pesticide labels and encourage farmers to use PPE.
- Train farmers on applying pesticides the proper distance (30 meters) from open bodies of fresh water, and not to wash their sprayers out in ponds, lakes, rivers, streams, or wetlands, or where rinse water may run off into these aquatic resources.
- Minimize chemical spray drift by using low-pressure sprays and nozzles that produce large droplets, properly calibrating and maintaining spray equipment, and use of a drift-control agent.
- Warn beekeepers of upcoming spray events so that they may move or protect their hives.
- Train farmers not to spray when honeybees are active and foraging.

4.8 Factor H: Conditions under Which the Pesticide Is To Be Used, Including Climate, Geography, Hydrology, and Soils

In general, in addition to covering biodiversity and protected areas under Factor G above, this requirement attempts to protect natural resources from the dangers of pesticide misuse and contamination, especially of scarce groundwater resources in Somalia.

Somalia Climate, Geography, Land Use and Hydrology

Somalia's geography, land use, surface hydrology and climate are described in the background section (Section 2) to this report, with maps of country relief, agriculture land use, surface hydrology and rainfall; refer to them for background on these factors.

Somalia Soils

¹⁰ Prepared by Ephantus Wahome, Environmental Procedures and Policies Specialist, USAID/REDSO

¹¹ <http://www.animalinfo.org/country/somalia.htm>

The site <http://earthsendangered.com/search-regions3.asp?search=1&sgroup=allgroups&ID=307> shows the major soil types in Somalia, and their use. Major soil types are the following:

- Northern part of Somalia: shallow sandy and/or stony soils and some deeper calcareous soils.
- The central part of the country: sandy soils along the coast and moderately deep loamy soils with a high content of calcium carbonate and/or gypsum further inland.
- Southern Somalia has low-lying alluvial plains along the Juba and Shabelle rivers: clayey soils with poor drainage and/or high content of salts. Some riverine areas are also liable to flooding.
- Southern inter-riverine areas: contain shallow soils and deep loamy and clayey soils.

The key for the PEG project is to overlay the maps on this website with a map of their project locations to see the major types of soils that their beneficiaries are working with. Some soils are better than others at holding and detoxifying pesticides (see issue, below), while others lead to rapid leaching of pesticides to scarce and valuable groundwater resources.

Issue: Pesticides can adsorb (stick to) to soil, leach and contaminate groundwater resources. Each pesticide has physical and chemical characteristics, such as solubility in water, ability to bind to soil particles and be held there (adsorbed) and their natural breakdown rate in nature. If they are strongly held by soil they do not enter the soil water layers and the ground water table as easily. A listing of these properties for at least some of the pesticides in use in Somalia can be found by checking at this website:
<http://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm>.

In general, pesticides with water solubility greater than 3 mg/liter have the *potential* to contaminate groundwater; and pesticides with a soil adsorption coefficient of less than 1,900 have the *potential* to contaminate groundwater. In addition, pesticides with an aerobic soil half-life greater than 690 days or an anaerobic soil half-life greater than 9 days have the *potential* to contaminate groundwater. Moreover, pesticides with a hydrolysis half-life greater than 14 days have *potential* to contaminate groundwater.

The potential for pesticides to enter groundwater resources depends, as indicated above, on the electrical charge contained on a pesticide molecule and its ability and propensity to adhere to soil particles, but this also depends on the nature and charge of the soil particles dominant in the agriculture production area. Sand, clay and organic matter, and different combinations of all of these, have different charges and adhesion potential for organic and inorganic molecules. Sandy soil often has less charge capacity than clay or organic matter, and will thus not interact significantly with and hold charged pesticide molecules. So, in areas with sandy soil, the leaching potential for pesticides is increased, as is the velocity with which water and the pesticide migrate.

A pesticide's ability to enter groundwater resources also depends on how quickly and by what means it is broken down and the distance (and thus time) it has to travel to reach the groundwater. If the groundwater table is high, the risk that the pesticide will reach it before being broken down is increased. Thus, a sandy soil with a high water table is the most risky situation for groundwater contamination by pesticides. Groundwater pollution (contamination) potential for each pesticide active ingredient available in Somalia is provided in Annex 5.

Since the risks for contamination of scarce water resources is high in much of Somalia, PEG and its sub-grantee should investigate these factors of soil adsorption and solubility before choosing pesticides to promote or support for their beneficiaries.

Recommendations

- **Hydrology.** Do not spray or rinse pesticide equipment in or within 30 meters of rivers, ponds, irrigation and drainage ditches, and other surface waters, including wetlands.
- Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
- **Soils:** Do not use or recommend for use herbicides or other pesticides with high leaching and groundwater pollution potential (see Annex 5) near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.
- **Soils:** Since transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely. Such techniques include vegetated buffer strips, green manure, mulching, terracing, employing wind breaks, employing ground covers between rows, planting rows perpendicular to the slope, and using drip irrigation.

4.9 Factor I: Availability of Other Pesticides or Non-Chemical Control Methods

This section identifies less toxic synthetic, as well as non-synthetic or ‘natural’ (extracts of naturally-occurring plants, spices, oils, fatty acids, induced resistance elicitors, minerals, microbes or microbial extracts) pesticide options for control of pests, and their relative advantages and disadvantages. Many of these ‘natural’ pesticides can be toxic to humans, and several are even classified as RUPs due to environmental risks; thus safe pesticide use practices extend to these natural as well as synthetic (produced in laboratories or factories) pesticides.

Annex 1—the heart of this PERSUAP—contains numerous non-chemical control methods for major pests of crops grown in Somalia. It is the intent of this PERSUAP that the PEG project will use this valuable resource, which compiles all known preventive IPM tools and tactics for each pest and disease of each crop and livestock. It can be considered as a pullout, stand-alone section that can be reproduced as necessary, and should be considered for translation into local languages, lamination, and distribution to farm input supply companies to help advise farmers at point-of-purchase. Annexes 2 and 3 provide guidelines for making PMPs and using IPM. Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.

Natural pest controls availability

Some Somali farmers produce their own artisanal or homemade pesticides, especially acaricides and fly repellents from naturally-occurring bush leaves and soil salts. With sufficient information, like that contained in Annex 10 of this PERSUAP, some plant extracts, especially essential oils, could be promoted and used in place of synthetic pesticide alternatives. (For purposes of USAID’s Pesticide Procedures, these natural pesticides also must be approved in a PERSUAP prior to recommending or using the pesticide.)

In general, most synthetic nematicides and soil pesticides/fumigants are very highly toxic. However, there are some companies producing next-generation natural chemicals in the USA: Bio Huma Netics, <http://www.bhn.name> for natural nematicides and Agra Quest, <http://www.agraquest.com> for bioactive essential oils.

Recommendation

- Preventive and natural IPM tools and tactics for each crop-pest combination (Annex 1) should be used before the choice is made to purchase and use synthetic pesticides. Annexes 2 and 3 provide guidelines for making PMPs and using IPM. Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.

4.10 Factor J: Host Country's Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of the Requested Pesticide

Infrastructure and Human Resources

Somalia's MOA does not test and register pesticides, and there are few resources for extension and there are no pesticide rules to enforce.

The above manuals provide up to date information on best practices for choice of, transport, storage, safe use, cleanup and disposal of pesticides. It provides practical information on PPE that should be used for different types of pesticides.

Disposal of obsolete pesticides

According to Internet resources, <http://www1.american.edu/ted/SOMALIA.HTM>, during the civil war, which began in 1989, a pesticide storage facility in the north of the country was destroyed. A fire spilled toxic smoke into the environment and chemicals drained and leached into a drinking water aquifer.

Due to the war and instability it has been impossible for the United Nations Food and Agriculture Organization (FAO) to enter Somalia to do a proper inventory of obsolete pesticide stores.

Disposal of pesticide containers

Information collected about the Somalia pesticide system (from interviews with MOA, agrodealers and farmers) indicates that most farmers do not understand the importance of safely disposing of empty pesticide containers. Many Somali farmers simply throw the empty containers in the field, or reuse them to store water or camel milk.

The best method for container disposal in Somalia is to triple-rinse the containers, puncture them to discourage re-use, and bury them or dispose of them in municipal waste. Burning plastic bottles and single-use pesticide sachets can lead to the formation of toxic fumes containing furans and dioxins, and is not recommended.

Recommendations

- Absolutely no POP or PIC chemicals will be used or supported on The PEG project.

- Where alternatives (Classes III and IV/U) exist, do not recommend or use EPA and WHO Acute Toxicity Class II pesticide products on The PEG project, unless the USAID project can verify that producers and laborers (pesticide applicators) properly and consistently utilize PPE as recommended by the pesticide label and MSDS.
- If a regional empty pesticide container recycling facility is constructed in the future, USAID should encourage its use.
- Train farmers to purchase inputs from suppliers that provide quality technical backup support, and to purchase and use PPE, or contract private pesticide spray services.

4.11 Factor K: Provision for Training of Users and Applicators

USAID recognizes that, in addition to the use of PPE, safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly critical in developing countries, where the level of education of applicators may typically be lower than in developed countries.

If pesticide use is supported by PEG and sub-grantee SATG, training in Safe Pesticide Use and target crops GAP/IPM tools and tactics are important for project beneficiary farmers using pesticides. Refresher trainings are superb for changing beneficiary farmer behaviors, especially as they expand their agricultural opportunities.

Recommendation

- Farmers require training and refresher training on how to choose the correct pesticide, do knapsack sprayer calibration and record keeping, as well as proper pest identification and IPM.
- Annex 6 Training Topics provides significant discussion of safe pesticide use training elements.

4.12 Factor L: Provision Made For Monitoring the Use and Effectiveness of Each Pesticide

Evaluating the risks, impacts and benefits of pesticide use should be an ongoing, dynamic process. Proper pesticide use and pest resistance are two of the risks that this factor is intended to address, as well as human health and safety and environmental effects.

Record keeping should track quantities and types of pesticides used, where they were used and what they were used for with notes on efficacy. Notes on effectiveness of individual pesticides and pest numbers will help develop a more sustainable pesticide use plan for PEG project beneficiary farmers. Farmers will need to keep records of any reductions in pesticide efficacy experienced, which is the first indication that resistance may be developing, and then a strategy needs to be in place to determine a shift to a different pesticide class, and rotation among classes, to overcome resistance development.

The following aspects should be included in the PEG and sub-grantee SATG-funded project record keeping system: Annex 7 provides formats and ideas for a field monitoring form for beneficiary farmer best practices including GAP and IPM options. Local regulatory compliance, if it becomes available during LOP: A list of country laws related to the use of agrochemicals for plant protection, short notes on the relevance of the law, dates the laws come into or exit force and MRLs for each crop-pesticide combination.

- A pesticide checklist: This list allows project agronomists to ensure that EPA registers the pesticides they are using. It should also provide notes on special safety requirements.
- GAPs/IPM measures tried/used (see Annex 1): USAID-funded project agronomists should try to incorporate a minimum of at least ten new IPM measures per annum and document their success or failure.
- PPE: Lists of the types of equipment made available to applicators, number of pieces, prices and contact details of suppliers, dates when equipment needs to be washed, maintained or replaced. PPE should be numbered or personally assigned to applicators to ensure that it is not taken into the home where (as a contaminated material) it could pose a risk to family members.
- Monitoring/recording pests: Agronomists should incorporate into their records regular field pest monitoring and identification. This could be done by PEG and sub-grantee SATG project agronomists themselves, or if properly trained, by farmers.
- Environmental conditions: Field conditions should be incorporated into the record keeping system (for example; precipitation, soil analyses and moisture, soil pH, temperatures and so on).
- Information should be transmitted at least annually and projects should report to USAID on this progress in pesticide safety and GAP/IPM use in annual reports.

SECTION 5: PESTICIDE SAFE USE ACTION PLAN (SUAP)

5.1 Introduction to SUAP

This Safe Use Action Plan, is the definitive statement of PEG project pesticide compliance requirements and is synthesized from the PER analysis:

- Section 5.2, immediately below, as part of a precision IPM program, directs readers to allowed (and rejected) pesticides, which are included in Annex 1, preventive and chemical GAP and IPM tools.
- Section 5.3 summarizes the recommended best practices and safer use conditions to be used/supported with these pesticides.
- The PEG SCS project will be required to insert into an EMMP each foreseeable risk, mitigation measure, indicator of mitigation success, monitoring timetable and responsible people/groups for implementation of these requirements, and for tracking compliance.

5.2 Somalia PEG project Pesticides Requested for Analysis

PEG requested an analysis of pesticides available in South-Central Somalia (included as Annex 10) for agricultural uses. SATG also requested approval to obtain three pesticides. The active ingredients in each of those pesticides are analyzed in the PER analysis and are compiled in Annex 5 for additional toxicological analyses.

The table below summarizes pesticide recommendations, precisely by target pest/disease genus and species, and findings of the PER analyses. Rejected pesticides AIs are found under the PER Factor a analysis.

Pesticide (AI)	Type	Target(s)	Crops/Livestock
garlic (<i>Allium sativum</i> oil extract)	artisanal insecticide	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
azadirachtin (neem tree, <i>Azadirachta indica</i> seed extract)	artisanal insecticide	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) Maize stalk borer (<i>Chilo partellus</i>); Maize aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>); Corn earworm (<i>Helicoverpa</i> = <i>Heliothis zea</i>, <i>H. armigera</i>) Legume pod borer (<i>Mauruca vitrata</i>); Legume aphids (<i>Aphis craccivora</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses) maize cowpea spinach
amitraz	livestock acaricide	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep
carbaryl	insecticide	<ul style="list-style-type: none"> Maize Aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>); Legume aphids (<i>Aphis craccivora</i>) Diamond Back Moth (<i>Plutela xylostella</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> maize cabbage spinach
capsaicin (chili pepper, <i>Capsicum oleoresin</i> , extract)	artisanal insecticide,	<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) 	<ul style="list-style-type: none"> Livestock fodder crops (Alfalfa, Dolichos legume,

Pesticide (AI)	Type	Target(s)	Crops/Livestock
	miticide	<ul style="list-style-type: none"> Maize Aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>) Broad mite (<i>Polyphagotarsonemus latus</i>) 	<ul style="list-style-type: none"> Sudan, Napier & Rhodes grasses) maize peppers/chilis
diatomaceous earth (mineral extract)	artisanal insecticide, livestock anti-helminthic	<ul style="list-style-type: none"> Livestock internal parasites and Helminths, Cysticercosis tapeworms, cestodes Facsiolosis flukes/trematodes Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep stored maize and cowpea
malathion	insecticide	<ul style="list-style-type: none"> Legume aphids (<i>Aphis craccivora</i>) Fruit Flies (<i>Ceratitis</i> species, <i>Dacus</i> species, and <i>Bactrocera</i> species) Western Flower Thrips (<i>Frankliniella occidentalis</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> cowpea melons onions spinach
permethrin	stored grain pests insecticide	<ul style="list-style-type: none"> Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> stored maize and cowpea
pirimiphos-methyl	stored grain pests insecticide	<ul style="list-style-type: none"> Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> stored maize and cowpea
pyrethrum (Chrysanthemum, <i>Tanacetum cinerariifolium</i> flower extract)	artisanal insecticide, miticide	<ul style="list-style-type: none"> Tomato leafminer (<i>Tuta absoluta</i>) Armyworms (<i>Mythimna unipuncta</i>) 	<ul style="list-style-type: none"> tomato Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
acetamiprid (recommended for use during vegetative growth, not during flowering to protect foraging honeybees)	insecticide, seed treatment insecticide	<ul style="list-style-type: none"> Legume aphids (<i>Aphis craccivora</i>) White fly (<i>Bemisia tabaci</i>) Diamond Back Moth (<i>Plutella xylostella</i>) Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> cowpea, mung bean tomato, melons cabbage spinach

Pesticide (AI)	Type	Target(s)	Crops/Livestock
beta-cyfluthrin (use formulations 10% and below)	livestock acaricide, insecticide	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) Mange mites (<i>Demodex</i> and <i>Sarcoptes</i> species) Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
deltamethrin (for all uses except on cotton)	livestock acaricide, insecticide	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) Mange mites (<i>Demodex</i> and <i>Sarcoptes</i> species) Tomato leafminer moth (<i>Tuta absoluta</i>) Fruit Flies (<i>Ceratitis</i> species, <i>Dacus</i> species, and <i>Bactrocera</i> species) Diamond Back Moth (<i>Plutela xylostella</i>) Whiteflies (<i>Bemisia</i> species) Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> Livestock: camels, cows, goats, sheep tomato melons cabbage okra Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
imidacloprid (recommended for use during vegetative growth, not during	insecticide, seed treatment insecticide	<ul style="list-style-type: none"> Maize stalk borer (<i>Chilo partellus</i>) Corn earworm (<i>Helicoverpa</i> = 	<ul style="list-style-type: none"> maize

Pesticide (AI)	Type	Target(s)	Crops/Livestock
flowering to protect foraging honeybees)		<i>Heliothis zea</i> , <i>H. armigera</i>) <ul style="list-style-type: none"> Legume aphids (<i>Aphis craccivora</i>) Tomato leafminer moth (<i>Tuta absoluta</i>) Melon aphids (<i>Aphis gossypii</i>) Diamond Back Moth (<i>Plutela xylostella</i>) Leaf miners (<i>Lyriomyza</i> species) White fly (<i>Bemisia tabaci</i>) Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> cowpea, mung bean tomato cabbage spinach tomato, melons, okra Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
cypermethrin (<i>not for horticultural use</i>)	livestock acaricide, stored grain crack & crevice treatment only	<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> Livestock: camels, cattle, goats, sheep Stored maize and beans
sulfur (natural product)	natural miticide, fungicide	<ul style="list-style-type: none"> Broad mite (<i>Polyphagotarsonemus latus</i>) Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) Powdery mildews (<i>Oidium lycopersici</i>, 	<ul style="list-style-type: none"> peppers/chilis maize tomato, melons, peppers/chilis

Pesticide (AI)	Type	Target(s)	Crops/Livestock
		<i>Leveilula taurica</i> <ul style="list-style-type: none"> • Anthracnosis (<i>Colletotrichum</i> species) • Fungal diseases (<i>Phytophthora</i>, <i>Verticillium</i>, <i>Fusarium</i> species) 	<ul style="list-style-type: none"> • Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses)
copper oxychloride (natural product)—use only WHO Classes II and III formulations and use eye protection	natural fungicide	<ul style="list-style-type: none"> • Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) • Fungal diseases (<i>Phytophthora</i>, <i>Verticillium</i>, <i>Fusarium</i> species) • Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveilula taurica</i>) • Anthracnosis (<i>Colletotrichum</i> species) 	<ul style="list-style-type: none"> • maize • Livestock fodder crops (Alfalfa, Dolichos legume, Sudan, Napier & Rhodes grasses) • maize, melons • peppers/chilis
potassium bicarbonate (natural product)	natural fungicide	<ul style="list-style-type: none"> • Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) • Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveilula taurica</i>) • Anthracnosis (<i>Colletotrichum</i> species) 	<ul style="list-style-type: none"> • maize • tomato, peppers/chilis • peppers/chilis
chlorothalonil (use only Class II and III products of less than 50% concentration, not Class I, and use eye protection)	fungicide	<ul style="list-style-type: none"> • Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) • Corn leaf blight (<i>Helminthosporium maydis</i>) • Early blight on leaves (<i>Alternaria</i> species) • Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveilula taurica</i>) • Onion smuts (<i>Urocystis</i>) 	<ul style="list-style-type: none"> • maize • tomato • onion

Pesticide (AI)	Type	Target(s)	Crops/Livestock
		<i>magica</i> = <i>cepulae</i> and <i>U. colchici</i>) <ul style="list-style-type: none"> Powdery mildew (<i>Leveillula taurica</i> (imperfect stage = <i>Oidiopsis taurica</i>)) 	<ul style="list-style-type: none"> peppers/chilis
glyphosate	herbicide	<ul style="list-style-type: none"> Weeds of all crops (broadleaves, grasses) 	<ul style="list-style-type: none"> all crops
glyphosate, isopropylamine salt	herbicide	<ul style="list-style-type: none"> Weeds of all crops (broadleaves, grasses) 	<ul style="list-style-type: none"> all crops

5.3 Compliance Requirements (Safer Use Measures)

The above-listed allowed pesticide AIs can only be used in compliance with the safer use measures and restrictions specified in the PER. These can be summarized as follows:

- A. Only pesticides approved by this PERSUAP may be supported with PEG SCS project funds. *Pesticide “support” = any of the following: use of USAID funds to: purchase pesticides; directly fund the application of pesticides; recommend pesticides for use; facilitate or enable the application or purchase of pesticides via provision of application equipment, credit support, or other means by the PI, their sub-grantee SATG and any other partners.*
- B. If pesticide use is supported, appropriate project staff, sub-grantee SATG & beneficiaries must be trained in IPM (Annexes 1, 2 and 3), safe pesticide use and pesticide first aid;
- C. To the greatest degree practicable, if pesticide use is supported by the PEG SCS project or their sub-grantee SATG they must require use and assure maintenance of appropriate PPE—as well as safe pesticide purchase, handling, storage and disposal practices.

Compilation of Compliance Requirements from PER analysis, by Factors A-L

Factor A Requirements for PEG/SCS and SATG

- PEG SCS and sub-grantee SATG will not promote, finance and use on demonstration farms, pesticides not registered by EPA for same or similar use, those classified by EPA as RUP products, or those deemed too toxic for smallholder farmers to use (all listed above).
- If PEG SCS and SATG wish to request the support of any non-EPA registered or RUP product by their project, including use on any demonstration farm, then a full EA must be done and approved by the BEO.
- PEG SCS and SATG shall obtain and retain copies of the MSDS for each pesticide that their beneficiary farmers use frequently.

Factor B Recommendations for PEG/SCS and SATG

- Farmers require training from PEG and sub-grantee SATG on how to choose the correct pesticide, instead of relying solely upon the advice of agrodealers and neighbors.

- Use training to encourage farmers to use products with lower human and ecological toxicities (see Annex 5) if there is a choice.

Factor C Recommendations for PEG/SCS and SATG

- Preventive IPM tools and tactics for each crop-pest combination (Annex 1) should be used before and combined with the use of synthetic pesticides.
- Somalia needs a national PMP with preventive tools and tactics to help reduce pests of major crops. World Bank assists many countries to produce these PMPs, and could be requested, if desired. Annex 1 of this PERSUAP provides GAP and IPM information for most Somali crop-pest combinations. Annexes 2 and 3 provide guidelines for making PMPs and using IPM.
- The PEG project and sub-grantee SATG are responsible for developing these IPM and PMP plans.
- Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.

Factor D Recommendations for PEG/SCS and SATG

- Train farmers on proper use of PPE as well as sprayer calibration, use, maintenance and empty container disposal by rinsing, puncturing and burial.
- Promote the concept of spray service providers.

Factor E Recommendations for PEG/SCS and SATG

- Train farmers on how to read safety precautions and first aid measures on pesticide labels and encourage them to use PPE.
- The pesticide safe use training required by this PERSUAP should include basic first aid for pesticide overexposure, availability and use of antidotes, and training on following recommendations found on pesticide labels and MSDSs for commonly used pesticides.

Factor F Recommendations for PEG/SCS and SATG

- Train and encourage farmers to value and buy higher quality products from name brand companies and that come with technical support.
- Train farmers on the ways to reduce the development of resistance, as follow:
 - Use IPM to minimize pesticide use
 - Avoid Knapsack Mixes
 - Avoid Persistent Chemicals
 - Use Long-term Pesticide Rotations

Factor G Recommendations for PEG/SCS and SATG

- Train farmers about ecotoxicity and on how to read ecotoxicity precautions on pesticide labels and encourage farmers to use PPE.
- Train farmers on applying pesticides the proper distance (30 meters) from open bodies of fresh water, and not to wash their sprayers out in ponds, lakes, rivers, streams, or wetlands, or where rinse water may run off into these aquatic resources.
- Minimize chemical spray drift by using low-pressure sprays and nozzles that produce large droplets, properly calibrating and maintaining spray equipment, and use of a drift-control agent.

- Warn beekeepers of upcoming spray events so that they may move or protect their hives.
- Train farmers not to spray when honeybees are active and foraging.

Factor H Recommendations for PEG/SCS and SATG

- Hydrology: Do not spray or rinse pesticide equipment in or within 30 meters of rivers, ponds, irrigation and drainage ditches, and other surface waters, including wetlands.
- Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
- Soils: Do not use or recommend for use herbicides or other pesticides with high leaching and groundwater pollution potential (see Annex 5) near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.
- Soils: Since transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely. Such techniques include vegetated buffer strips, green manure, mulching, terracing, employing wind breaks, employing ground covers between rows, planting rows perpendicular to the slope, and using drip irrigation.

Factor I Recommendations for PEG/SCS and SATG

- Preventive and natural IPM tools and tactics for each crop-pest combination (Annex 1) should be used before the choice is made to purchase and use synthetic pesticides. Annex 3 provides guidelines for making PMPs and using IPM. Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.

Factor J Recommendations for PEG/SCS and SATG

- Absolutely no POP or PIC chemicals will be used or supported on The PEG project.
- Where alternatives (Classes III and IV/U) exist, do not recommend or use EPA and WHO Acute Toxicity Class II pesticide products on The PEG project, unless the USAID project can verify that producers and laborers (pesticide applicators) properly and consistently utilize PPE as recommended by the pesticide label and MSDS.
- If a regional pesticide container recycling facility is ever begun in the future, USAID should encourage its use.
- Train farmers to purchase inputs from suppliers that provide quality technical backup support, and to purchase and use PPE, or contract private pesticide spray services.

Factor K Recommendations for PEG/SCS and SATG

- Farmers require training and refresher training on how to choose the correct pesticide, do knapsack sprayer calibration and record keeping, as well as proper pest identification and IPM.
- Annex 6 Training Topics provides significant discussion of safe pesticide use training elements.

Factor L Recommendations for PEG/SCS and SATG

- Annex 8 provides formats and ideas for collecting farm pesticide use information.

- Local regulatory compliance, if it becomes available: A list of country laws related to the use of agrochemicals for plant protection, short notes on the relevance of the law, dates the laws come into or exit force and MRLs for each crop-pesticide combination.
- A pesticide checklist: This list allows project agronomists to ensure that EPA registers the pesticides they are using. It should also provide notes on special safety requirements.
- GAPs/IPM measures tried/used (see Annex 1): USAID-funded project agronomists should try to incorporate a minimum of at least ten new IPM measures per annum and document their success or failure.
- PPE: Lists of the types of equipment made available to applicators, number of pieces, prices and contact details of suppliers, dates when equipment needs to be washed, maintained or replaced. PPE should be numbered or personally assigned to applicators to ensure that it is not taken into the home where (as a contaminated material) it could pose a risk to family members.
- Monitoring/recording pests: Agronomists should incorporate into their records regular field pest monitoring and identification. This could be done by the Somalia PEG agriculture sector and value chain project agronomists themselves, or if properly trained, by farmers.
- Environmental conditions: Field conditions should be incorporated into the record keeping system (for example; precipitation, soil analyses and moisture, soil pH, temperatures and so on).
- Information should be transmitted at least annually and projects should report to USAID on this progress in pesticide safety and GAP/IPM use in annual reports.

The PER and the annexes provide substantial resources to support compliance with these requirements, as detailed in the table below.

IPM/Safe Use Requirement	Key Resources Provided
<p>Pesticide recommendations and use must be governed by a set of crop- and pest-specific IPM-based pest management plans.</p> <p>(The PEG project and sub-grantee SATG are responsible for developing these plans.)</p>	<p>Annex 1 sets out in table format crop-by-crop, pest-by-pest (in most cases with precise genus and species names), preventive non-chemical as well as chemical management methods recommended by this PERSUAP. This is intended to serve as the basis for a crop-specific pest management plan. Annexes 2 & 3 provide guidelines for making PMPs and using IPM.</p> <p>Annex 5 provides toxicology information for each approved active ingredient, including human acute toxicities and chronic health issues, water pollution potential, as well as potential ecotoxicities to important non-target organisms like fish, honeybee pollinators, birds and several aquatic organisms.</p> <p>Annex 10 provides a list of botanical and natural pesticides that may be made artisanally and used in place of synthetic pesticides.</p>
<p>If pesticide use is supported, appropriate PEG project staff/sub-grantee SATG &</p>	<p>Annex 6 Training Topics provides significant discussion of safe use training elements.</p>

beneficiaries must be trained in safe pesticide use & pesticide first aid	
If pesticide use is supported, farm compliance monitoring forms should be used	Annex 7 provides formats and ideas for a field monitoring form for beneficiary farmer best practices including GAP and IPM options.
If pesticide use is supported, PEG project and sub-grantee SATG must be systematic in their pesticide-related record-keeping and monitoring	Annexes 8 provides pesticide use record-keeping templates/aids

[Insert Project Name]

Pesticide Safer Use Action Plan & Compliance Tracker*

Must be submitted to AOR/COR by June 30, 2015 and annually updated thereafter.

BASIC INFORMATION		SUBMISSION DATES:	
Prime Contractor		Initial submission	
Project		Annual Update #1	
Pesticide Compliance Lead & Contact Information	:	Annual Update #2	
Summary of Pest Management Needs on Project		Annual Update #3	

Note: Pesticide “support” = use of USAID funds to: purchase pesticides; directly fund the application of pesticides; recommend pesticides for use; enable the application or purchase of pesticides via provision of application equipment, credit support, etc.

Required Compliance (Mitigation) Measure	Initial Compliance Status (if known, indicate)	Actions planned to achieve & maintain compliance (w/ deadlines & responsible party)	Status of compliance actions
SUPPORT ONLY THE PESTICIDES AUTHORIZED BY THE 2015 USAID/SOMALIA PEG SCS PERSUAP			
Immediately			
Inventory Pesticides being supported and ensure NO SUPPORT for Class I chemicals.			
		(Insert extra rows if needed)	
Distribute copies of the list of allowed AIs with matching commercial product names to all project field extension			

staff & advise regarding the April 31, 2015 deadline for compliance (below)			
As soon as possible but not later than June 30, 2015			
Assure that USAID-funded pesticide support is limited to ONLY PESTICIDES APPROVED BY PERSUAP. Continue verification throughout life-of-project			
Pesticide technical assistance and use must be governed by a set of locally adapted crop-and-pest specific IPM-based pest management plans and observe enumerated use restrictions.			
By July 15, 2015			
Starting from the information in PERSUAP Annex A and drawing on PERSUAP Annex B, adopt/develop crop- and pest-specific IPM-based pest management plans (PMPs). For chemical controls, PMPs must include the use restrictions specified in the Annex B pesticide profiles. (E.g. no use near surface waters.) Note: sharing/collaboration among projects is encouraged.			
Translate PMPs into crop-specific field reference guides or posters for farmers to anticipate and manage pests.			
By July 15 2015			
Provide first-time training to appropriate project staff, partners and beneficiaries in PMPs; Provide refresher training annually.			

From Date of Initial Training			
Require and enforce PMP implementation in situations where the project has direct control over pesticide use			
Require and enforce that field extension under direct project control be PMP-based.			
Where project control over extension or agricultural practice on the ground is less than complete, promote and support to PMPs to the greatest practicable extent.			
Ongoing over Life of Project (LOP)			
Modify PMPs over LOP based on ground-truthing/field experience.			
Appropriate project staff & beneficiaries must be trained in safer pesticide use & pesticide first aid.			
Develop a Training Plan for Pesticide Safe Practices and IPM for project staff and beneficiaries, including at least annual refresher training. *			
Develop or source curricula conforming to required training topics specified in Annex 6.			
Implement training plan, providing first-time training to all relevant staff and beneficiaries within 6 months.			
To the greatest degree practicable, projects must require use & maintenance of appropriate PPE – as well as safe pesticide purchase, handling, storage and disposal practices.			
If carbamate or organophosphate-class			

pesticides are used extensively, follow procedures for baseline testing for cholinesterase inhibition, and establish a periodic cholinesterase monitoring schedule when necessary.			
Implement/observe core risk mitigation measures (PPE and other precautions) identified in the summary section of each extended pesticide profile. Where control is less complete, take all practicable measures to support and promote implementation of these measures.			
Whenever providing, supporting or recommending pesticides for use, assure that appropriate personal protective equipment is available and, to the degree possible, require its use.			
Whenever directly using, procuring or supplying pesticides, assure that quality application equipment is available and local capacity for its available and maintained.			
To the greatest degree practicable, enforce good disposal and clean-up practice			
For directly supported pesticide stores, assure that Best Management Practices (BMPs) are met (see Annex 9 for website references to sector BMPs). For directly supported pesticide transport, assure that minimum			

practices specified in Annex C are met.			
Projects must be systematic in their pesticide related record-keeping and monitoring.			
Pesticide efficacy in demonstration plots must be evaluated			
Any evidence of pesticide resistance development must be tracked and reported.			
Flow-down requirements			
Prime contractors must write pesticide compliance requirements as set out above into each grant or sub-contract that will involve support for pesticide use.			

*** This table is not conclusive and the IP will have to include more specific mitigation measures, e.g bee colony impact trackers**

Annex 1: Matrix of South-Central Somalia PEG-Targeted Livestock & Crops with Primary Production Constraints, PERSUAP-Recommended Pest Prevention GAP/IPM Tools and Tactics & PERSUAP-Recommended Curative Pesticides

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
Livestock (Camels, goats, cattle and sheep)		
<ul style="list-style-type: none"> Savannah and Riverine species of Tsetse flies (<i>Glossina</i> species) that transmit trypanosome protozoans to livestock 	<ul style="list-style-type: none"> Use, on an area-wide basis, odor baited traps and targets with insecticide to attract and kill savannah tsetse. Use, on an area-wide basis, specially colored traps with insecticides to attract and kill savannah tsetse. If available from Kenya, the Sterile Insect Technique can be used on an area-wide basis to reduce tsetse fly populations significantly. Use fly repellents if the technology becomes available in neighboring countries. Use indigenous plant extracts to repel flies. 	<ul style="list-style-type: none"> Rotate among pour-on formulations of insecticides containing deltamethrin, or spray-on formulations containing beta-cyfluthrin, cypermethrin or amitraz. Inject anti-trypanosome drugs.
<ul style="list-style-type: none"> Cattle ticks (<i>Rhipicephalus pulchellus</i>, <i>Boophilus decoloratus</i>, <i>Hyalomma marginatum rufipes</i>, <i>Amblyomma variegatum</i>) and other tick species that transmit several diseases like Anaplasmosis rickettsia to livestock 	<ul style="list-style-type: none"> If available, tick resistant cattle breeds exist and may be used. Use clean syringes if blood entry or transfer occurs. Check animals routinely for ticks and remove ticks by hand. Some local aromatic shrubs provide extracts that can be used as tick repellents. Brush removal and mowing the vegetation next to wooded areas. Rotate livestock away from the pastures that are heavily infested with ticks. Sanitation: Where animals are concentrated in night corrals, clean up and remove all weeds and animal waste. 	<ul style="list-style-type: none"> Preventive vaccination of cattle against tick-borne diseases. Rotate among pour-on formulations of insecticides containing deltamethrin, or spray-on formulations containing beta-cyfluthrin, cypermethrin or amitraz every 21 days.
<ul style="list-style-type: none"> Mange mites (<i>Demodex</i> and <i>Sarcoptes</i> species) 	<ul style="list-style-type: none"> Don't over-crowd animals. Provide animals with sufficient space, so they are not in close contact with each other. Use indigenous knowledge and saltpan dips and washes to reduce mites. Use indigenous plant extracts to reduce mites. 	<ul style="list-style-type: none"> Use of miticides is rarely justified. However if desired, pour-on formulations containing deltamethrin or spray-on amitraz used against ticks and flies will reduce mite populations.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
Biting flies <ul style="list-style-type: none"> Horseflies (Tabanids) that draw blood and worry livestock Stable fly (<i>Stomoxys calcitrans</i>), some of which transmit trypanosomes to livestock 	<ul style="list-style-type: none"> Eliminate development sites such as decomposing vegetation. Sanitation: Clean up and remove all fresh animal manure and manure pats. If compost piles of manure are maintained for horticultural use, put fresh grass clippings into them and turn them regularly to disrupt fly breeding. Use indigenous plant extracts to repel flies. 	<ul style="list-style-type: none"> Chemical control is not usually cost-effective, as animals would need to be treated every other day with a pyrethroid pesticide.
<ul style="list-style-type: none"> Dairy cattle Mastitis bacteria (<i>Streptococcus</i> and <i>Staphilococcus</i> species) 	<ul style="list-style-type: none"> Maintain clean technique when milking. Clean milking equipment daily. 	<ul style="list-style-type: none"> Treat animal teats with a solution of chlorine or iodine and Iodoline.
Protozoan parasites <ul style="list-style-type: none"> African Animal Trypanosomosis (AAT) protozoans Babesiosis protozoans 	<ul style="list-style-type: none"> Control the fly vectors (see tse-tse fly above) of these diseases. Inject anti-trypanosome drugs. 	<ul style="list-style-type: none"> No pesticides are used against trypanosomes (but they are used to control tse-tse fly vectors, see above).
Livestock Diseases <ul style="list-style-type: none"> Brucellosis (<i>Brucella abortus</i>) bacteria Anaplasmosis rickettsia Anthrax bacteria Contagious Caprine Pleuropneumonia (CCPP) bacteria Lumpy Skin virus Peste de Petits Ruminants Ovine Rinderpest virus 	<ul style="list-style-type: none"> Use of vaccines is the most effective preventive tool for reducing the chance of livestock infections. Use clean syringes if blood entry or transfer occurs. Check animals routinely for ticks and remove ticks by hand. Some local aromatic shrubs provide extracts that can be used as tick repellents. Brush removal and mowing the vegetation next to wooded areas. Rotate livestock away from the pastures that are heavily infested with ticks. Sanitation: Where animals are concentrated in night corrals, clean up and remove all weeds and animal waste. 	<ul style="list-style-type: none"> Antibacterial options include the use of injectable and oral oxytetracycline (veterinary antibiotics are not considered to be pesticides, and are not covered in Regulation 216). There are no virucides available to control viral diseases.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
<ul style="list-style-type: none"> Rabies virus Salmonellosis bacteria 		
Livestock internal parasites/Helminths <ul style="list-style-type: none"> Cysticercosis tapeworms/cestodes Facsiolosis flukes/trematodes 	<ul style="list-style-type: none"> Breed local livestock with known resistant breeds. Controlling the density of livestock (stocking rate). Overstocking forces the animals to graze closer to faecal material and closer to the ground, and may result in the consumption of a higher number of infective larvae. Periodic deworming. Strategic deworming when conditions are most favourable for larval development on the pasture. Separating age groups in the more intensive production systems. Reducing the effects of gastro-intestinal parasites by assuring an adequate plane of nutrition. Control programmers should reduce the effect of parasites to sub-economic levels. Using grazing management to minimize the uptake of infective larvae and to create safe pastures. 	<ul style="list-style-type: none"> The repeated use of natural diatomaceous earth is a useful anti-helminth. Internal antibiotics like those containing Ivermectin are not considered to be pesticides.
Livestock Fodder (Alfalfa/Lucerne legume, Dolichos legume, Sudan grass, Napier grass, Rhodes grass)		
<ul style="list-style-type: none"> Armyworms (<i>Mythimna unipuncta</i>) 	<ul style="list-style-type: none"> Natural enemies like ground beetles, spiders, damsel bugs, minute pirate bugs, assassin bugs, bigeyed bugs, and lacewing larvae naturally control armyworms. Parasitic wasp species <i>Trichogramma</i>, <i>Copidosoma</i>, <i>Apanteles</i>, <i>Diadegma</i>, and <i>Hyposoter</i> sting and parasitize eggs and larvae (some of these organisms are available for purchase commercially). Control weeds on field margins and in the field. Sanitation: Remove and destroy all crop residues. 	<ul style="list-style-type: none"> Use of artisanal extracts of garlic, chili pepper, neem tree seed extract or pyrethrum.
<ul style="list-style-type: none"> Weevils Alfafa Weevil (<i>Hypera postica</i>), Egyptian alfalfa weevil (<i>H. brunneipennis</i>) 	<ul style="list-style-type: none"> Natural weevil parasitoids exist and exert significant control. Plant a parsley trap crop to attract and destroy weevils by plowing them under. Clean weeds from field and field margins. Use crop rotation. Sanitation: Disc or plow under crop residues. 	<ul style="list-style-type: none"> Can use natural insecticide containing diatomaceous earth. Seeds can be treated with synthetic insecticides containing imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder). Can use synthetic insecticides containing beta-cyfluthrin or deltamethrin.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
<ul style="list-style-type: none"> Fungal diseases (<i>Phytophthora</i>, <i>Verticillium</i>, <i>Fusarium</i> species) 	<ul style="list-style-type: none"> Use certified clean resistant seed that has been produced in dry areas. Sanitation: Remove weeds in and around field and destroy crop residues after harvest. 	<ul style="list-style-type: none"> Use natural fungicides containing sulfur or WHO Class II and III copper oxychloride compounds (with eye protection) before or as disease is forming under leaves.
Maize		
<ul style="list-style-type: none"> Maize stalk borer (<i>Chilo partellus</i>) 	<ul style="list-style-type: none"> Improve & manage soil fertility. Use resistant varieties (TMV-1, Staha, and others). Use seed treated with insecticide. Intercrop with beans and sunflower. Intercrop with borer-repellent <i>Desmodium</i> plant (see ICIPE Push-Pull Strategy at http://www.push-pull.net/3.shtml). Use crop rotation with legumes. Control weeds on field margins. Sanitation: Collect or destroy (by feeding to livestock, disking or plowing under) crop stalk residues at end of season. 	<ul style="list-style-type: none"> Apply artisanal neem powder and/or extract to the whorl when first larval damage appears. A preventive seed treatment with imidacloprid. At least 45 days post-emergence from treated seed, broadcast a spray with imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
<ul style="list-style-type: none"> Maize Aphids (<i>Rhopalosiphum maidis</i>, <i>Myzus persicae</i>) 	<ul style="list-style-type: none"> Natural enemies include Braconid parasitoids, ground beetles, spiders, rove beetles, ladybird beetles, lacewings, damsel bugs, aphid midges and hoverfly larvae. To monitor aphid populations, examine the undersides of the leaves and the bud areas for groups or colonies of aphids. Prompt control is necessary as aphids can multiply rapidly. Grow different crops or grow crops in rotation every cropping season. This practice provides food, shelter, and it increases the number of natural enemies that prey on aphids. At the same time, it disrupts the aphids' lifecycle and maintains its population below the economic threshold level. Plant trap crops such as lupine, nasturtiums, and timothy grass near the crop to be protected (plow under or spray). Anise, chives, garlic, onions, and radish are good companion crops. Control ants that protect aphids. Avoid using heavy doses of highly soluble nitrogen fertilizers. Instead apply fertilizer into 3 phases: during seeding, vegetative, and reproductive stages of plant growth. Use yellow sticky board traps placed in field (spread used motor oil on yellow painted plastic, thick cardboard or wood). 	<ul style="list-style-type: none"> Use botanical and homemade water extracts of chili or neem. If available, can apply synthetic pesticides containing carbaryl.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
<ul style="list-style-type: none"> Corn earworm (<i>Helicoverpa</i> = <i>Heliothis zea</i>, <i>H. armigera</i>) 	<ul style="list-style-type: none"> Choose corn varieties with tight husks to prevent larva from entering. These varieties show some characteristics and tolerance to the feeding habits of the corn earworm. Ask assistance from the local agriculturist office for these varieties are available in the markets. Begin monitoring and sampling soon after corn emergence but pay particular attention to corn that is silking in late summer/early fall. The presence of large numbers of eggs on fresh corn silks indicates the potential for damaging populations. Eggs hatch in 5 to 7 days following oviposition. Once larvae enter the corn ears, control with insecticides is difficult. Practice crop rotation. Avoid planting crops successively that are hosts to corn earworm like corn, cotton, sorghum, tobacco, soybean, and tomato. Two weeks before planting, remove weeds and grasses to destroy earworm larvae and adults harboring in those weeds and grasses. Plow and harrow fields at least 2 times before sowing seeds. This will expose pupae of corn earworm to birds, ants and other predators. Corn earworm pupates in the soil. After harvest, remove corn stubble by feeding to cows. Make and use pheromone or light traps: To make trap, use 1-liter containers. Cut 3 large holes into the sides of the container for the insects to enter. Fill the bottom half with soapy water. Suspend the pheromone capsule from the lid using string or wire then snap the trap closed. Attach the trap to a bamboo pole or stake. Erect bamboo/wooden poles as bird perches, or put bat houses near the cornfield. 	<ul style="list-style-type: none"> Botanical and homemade water extracts of neem seed may be used. Insecticidal control of corn earworm is difficult and depends on proper timing and thorough coverage. Direct insecticidal control towards young larvae that are feeding on the exposed ear tips. Treatments are usually not needed on field or silage corn. In sweet corn, where tolerance for worm damage is low, timing of insecticide treatments is critical: begin treatments during silking stage, at the start of egg hatch. Apply additional treatments if they are necessary. Sprays of pesticides containing systemic imidacloprid may be used during ear maturation since maize is wind-pollinated, not honeybee pollinated.
<ul style="list-style-type: none"> Downy mildew (<i>Sclerospora graminicola</i>, <i>Sclerophthora</i> species, <i>Peronosclerospora sorghi</i>) 	<ul style="list-style-type: none"> Use improved and resistant varieties. Rogue or remove heavily diseased plants. 	<ul style="list-style-type: none"> Use natural fungicides containing copper oxychloride (use only Class II and III products, not Class I, and use eye protection), sulfur or potassium bicarbonate. If heavy attack is experienced in unfavorable (continuously damp) weather, use seed treatment fungicides containing chlorothalonil.
<ul style="list-style-type: none"> Corn leaf blight (<i>Helminthosporium maydis</i>) 	<ul style="list-style-type: none"> Use of disease-resistant hybrids of maize. Use of certified disease-free seed. Use crop rotation with non-grass crops. 	<ul style="list-style-type: none"> Treatment of grain and sowings with fungicides containing chlorothalonil.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
	<ul style="list-style-type: none"> Sanitation: removal and destruction of infected maize residues. 	
<ul style="list-style-type: none"> Maize Rusts (<i>Puccinia sorghi</i>, <i>Puccinia polysora</i>) 	<ul style="list-style-type: none"> Use rust resistant or tolerant varieties or hybrids. Maintain soil and plant health (test these with lab tests). Destroy infected residue. Rotate maize with other crops. 	<ul style="list-style-type: none"> Generally, fungicides are not needed or economical.
Legumes (Cowpea, Mung bean)		
<ul style="list-style-type: none"> Legume pod borer (<i>Mauruca vitrata</i>) 	<ul style="list-style-type: none"> Use pod borer resistant cultivars of cowpea. Parasitoids of Maruca pod borers include wasps in the Braconid family and tiny egg parasitic Trichogramma wasps. Predators include spiders and praying mantis. Use trap crops of <i>Crotalaria juncea</i> (Sunn hemp, Indian hemp, Madras hemp). Practice crop rotation. Planting non-leguminous crops every cropping season breaks the life cycle of bean pod borers. Intercropping sorghum with cowpea reduces the incidence of pod borer. Eradicate the weed host wild pea (<i>Sesbania</i> spp.) from cropping areas. 	<ul style="list-style-type: none"> Pesticides are most effective if applied before larvae enter pods. Use botanical and homemade water extracts of neem at the flowering stage.
<ul style="list-style-type: none"> Legume aphids (<i>Aphis craccivora</i>) 	<ul style="list-style-type: none"> Many predators and parasites attack aphids, especially in fields that are not sprayed or sprayed with less toxic materials. Common predators of aphids in beans include lady beetles, syrphid flies, and green lacewings. These and parasitoids generally keep aphid populations under control. Monitor the crop regularly. Use regular monitoring with yellow sticky traps. Use resistant varieties. Use sanitation. Remove infested culls and weedy species around fields that may harbor the aphid between crops. 	<ul style="list-style-type: none"> Aphid controls in beans are seldom necessary, but if it is desired use spot treatments of natural insecticides containing neem seed extract or synthetic insecticides containing malathion or carbaryl. Use products with imidacloprid or acetamiprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
Maize and Legume Storage		
<ul style="list-style-type: none"> Granary Weevils (<i>Sitophilus</i> species) 	<ul style="list-style-type: none"> Do routine monitoring. Ensure good pest identification; understand pest biology, ecology, and behavior. Use good sanitation and good grain storage practices, as follows: All grain stored off the floor on pallets, with space between pallets, well 	<ul style="list-style-type: none"> Can use natural artisanal diatomaceous earth. If needed, can use powdered insecticides containing pirimiphos-methyl and permethrin (like Actellic Super), if they

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
	<p>ventilated/aerated and lighted, dispose of old containers.</p> <ul style="list-style-type: none"> • In empty shipping containers, thoroughly sweep or brush down walls, ceilings, ledges, braces, and handling equipment, and remove all spilled debris. • Brush, sweep out and/or vacuum the truck beds, augers, and loading buckets to remove insect-infested grain and debris. • Remove all debris from fans, exhausts, and aeration ducts (also from beneath slotted floors, when possible). • Remove all debris and vegetation growing within ten feet of the warehouses (preferably the whole storage area). • Examine area to determine if rodent bait stations are required, and use if needed. Be sure to follow all label directions. • Spray cleaned area around bins with a residual herbicide to remove all undesirable weedy plants. • Remove all debris from the storage site and dispose of it properly. • Frequent rotation of the stocks, "FIFO" (First In - First Out) rule applies. • Use sticky traps to monitor for presence and quantity. 	<p>become available.</p> <ul style="list-style-type: none"> • Can use formulations of cypermethrin to treat cracks and crevices in the storage warehouse.
<ul style="list-style-type: none"> • Aflatoxin contamination (<i>Aspergillus</i> species) 	<ul style="list-style-type: none"> • Use certified clean seed. • Use hybrid varieties with resistance to <i>Aspergillus</i>. • Plant early and avoid drought stress, if possible. • Control insects that damage the husk, ear and kernels. • Control fertilizer applications carefully and according to extension timing recommendations so as to not over-apply or apply at the inopportune time. • Harvest early and on time (the longer maize is left in the field, the higher the aflatoxin content). • Avoid or reduce kernel damage during harvest. • Dry and store maize at less than 13% moisture. • Keep storage facilities clean and cool, with proper ventilation. • Screen incoming corn for infection (see mold colors), remove and destroy (burry or burn) diseased ears. 	<ul style="list-style-type: none"> • Commercial biological treatments are available in Kenya, called Afla-Guard and AF36. If desired, try to get these available and try them. • Few synthetic fungicides provide economically efficient control of aflatoxin molds.
Tomato		
<ul style="list-style-type: none"> • Tomato leafminer moth (<i>Tuta absoluta</i>) larvae that mine leaves and enter fruit 	<ul style="list-style-type: none"> • Use pheromone traps, yellow sticky traps. • Use resistant varieties. • Do rotation with non-solanaceous crops. 	<ul style="list-style-type: none"> • Can use natural insecticides containing pyrethrum. • Can use synthetic insecticides containing imidacloprid (but only when plants are in

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
	<ul style="list-style-type: none"> Use proper recommended fertilizer and irrigation to keep plants strong. Sanitation: Plowing under or destruction of infested plants and of post-harvest plant debris. 	vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder) or deltamethrin.
<ul style="list-style-type: none"> White fly (<i>Bemisia tabaci</i>) that transmit Tomato Leaf Curl Virus (LCV) 	<p>For Whiteflies</p> <ul style="list-style-type: none"> Controlled well in nature by hymenopteran parasitoids (<i>Encarsia</i> species), lady beetles and minute pirate bugs. Yellow sticky traps may be used to reduce populations but cannot prevent the spread, once established. Frequent crop monitoring. <p>Prevention of LCV</p> <ul style="list-style-type: none"> Use seed that has been treated to eliminate seed borne inoculum. Extreme sanitation is needed. Practice crop rotation. Destroy infected plants especially before flowering and fruit set. Control solanaceous weeds. Remove possible source of primary inoculums (infected seeds, weeds, tobacco products). 	<p>Control of Whiteflies</p> <ul style="list-style-type: none"> At crop initiation, seed or soil application of a synthetic systemic insecticide like imidacloprid, acetamiprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder). <p>Control of LCV</p> <ul style="list-style-type: none"> There are no viral controls.
<ul style="list-style-type: none"> Early blight on leaves (<i>Alternaria</i> species) 	<ul style="list-style-type: none"> Use tolerant varieties. Drain the growing area adequately before planting. Follow proper planting date; do not plant late. Farmers use sticks and lines to raise tomato plants and fruit into the air to aerate the plant and raise the leaves and fruit away from the soil. 	<ul style="list-style-type: none"> Use synthetic fungicides containing chlorothalonil.
<ul style="list-style-type: none"> Powdery mildews (<i>Oidium lycopersici</i>, <i>Leveillula taurica</i>) 	<ul style="list-style-type: none"> The first line of defense against wilt is to use disease-free seedlings. Destroy whole plant and root after harvest. Use resistant varieties (for example <i>Roma VF</i>). Use natural and plastic soil mulches. Follow strict field sanitation. Remove solanaceous weeds. Practice rotation with non-solanaceous crops (minimum 5 years). 	<ul style="list-style-type: none"> Use natural preventive fungicides containing copper oxychloride (use only Class II and III products, not Class I, and use eye protection), sulfur or potassium bicarbonate. Fungicides will control the spread of disease but will not eliminate it; try fungicides containing chlorothalonil.
<ul style="list-style-type: none"> Broomrape parasitic weed (<i>Orobancha</i>) 	<ul style="list-style-type: none"> Plant only certified seed and clean nursery stock to avoid introducing broomrape species into production fields. 	<ul style="list-style-type: none"> There are no recommended chemical controls for broomrape.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
<i>aegyptiaca</i>)	<ul style="list-style-type: none"> Seed may survive in the soil for many years; so repeated annual monitoring is essential. Broomrape seeds are very small and easily separated from most vegetable crop seed. However, seed are also easily transported on contaminated equipment and in irrigation or floodwater. Broomrape may survive on several hosts other than tomato including many common agricultural weeds. Surveys of infested or previously infested fields should include surrounding field borders that may act as a refuge. Strategies for dealing with infestations include pulling up broomrape plants by hand before flowering Plant trap crops that will induce broomrape to germinate and then plow them under before they flower. Heavily infested fields may need to be rotated to non-susceptible crops for at least two years. Avoid grazing livestock on infected plants, and staying away from the use of hay produced from broomrape-infested plants are methods to help prevent the movement of broomrape seeds. 	
Melons		
<ul style="list-style-type: none"> Whiteflies (<i>Bemisia tabaci</i>) 	<ul style="list-style-type: none"> Controlled in nature by hymenopteran parasitoids (<i>Encarsia</i> species), lady beetles and minute pirate bugs. Monitoring crops and establishment of a pesticide program after finding 1 white fly per 10 plants, spraying may be used. Yellow sticky traps may reduce populations but cannot prevent the spread. 	<ul style="list-style-type: none"> Resistance can form if insecticides are not rotated. Rotate among synthetic insecticides containing imidacloprid or acetamiprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
<ul style="list-style-type: none"> Fruit Flies (<i>Ceratitis</i> species, <i>Dacus</i> species, and <i>Bactrocera</i> species) 	<ul style="list-style-type: none"> Ants are natural enemies of fruit flies. Keep field weed-free. Use recommended plant spacings, do not plant seeds too close. Dry season suppression: Till area under infested melons to kill pupae. Sanitation: Destroy infested melons before larvae emerge. 	<ul style="list-style-type: none"> Few pesticide methods are available for control. Synthetic insecticides containing deltamethrin or malathion may be spot-applied on places where infested melons rested, larvae entered the soil, and where adults will emerge.
<ul style="list-style-type: none"> Powdery mildews 	<ul style="list-style-type: none"> Control irrigation water. 	<ul style="list-style-type: none"> Rotate among natural fungicides

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
(<i>Oidium</i> species, <i>Sphaerotheca fuliginea</i> , <i>Erysiphe cichoracearum</i>)	<ul style="list-style-type: none"> Resistant varieties are available for control. Use crop rotation. Sanitation: Remove and destroy dead plants. Control weeds in and around field. Increase light intensity by planting at proper recommended intervals. 	containing sulfur or copper oxychloride (use only Class II and III products, not Class I, and use eye protection).
<ul style="list-style-type: none"> Watermelon mosaic virus (WMV, transmitted mechanically with field tools and by aphids, <i>Aphis gossypii</i>) 	<p>WMV</p> <ul style="list-style-type: none"> Use resistant varieties available. Use only certified disease-free clean planting material. Monitor plants continuously and carefully for disease symptoms. Clean field tools with disinfectant. Keep field and margins free of weeds. <p>Prevention of aphid vectors</p> <ul style="list-style-type: none"> Monitor aphid populations with field visits and yellow sticky traps. Many types of natural enemies and pathogens may control these aphids under low insecticide input situations. Sanitation: Field disking and destruction of crop residues are important for control of aphid pests of leafy vegetables to reduce their migration into nearby crops. 	<p>WMV</p> <ul style="list-style-type: none"> There are no commercially available virucides. <p>Control of aphid vectors</p> <ul style="list-style-type: none"> If control is needed, treat when aphids are found to be reproducing, particularly when second and later generation wingless females have started reproduction. Aphid populations are easier to control before the plants begin to cup. Spot-treat aphids only where the disease appears, use acetamiprid or imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
Onion		
<ul style="list-style-type: none"> Western Flower Thrips (<i>Frankliniella occidentalis</i>) 	<ul style="list-style-type: none"> Control soil moisture. Floating row covers exclude onion fly. During the growing season, minimize damage to bulbs caused by insects and diseases. Provide for quick drying following topping, especially if temperatures are high. Rotate 3 to 4 years out of onions, garlic, and leeks. Control other soil insects and foliage diseases that cause wounds entered by onion fly larvae. Harvest only after onion tops are well matured, cure onions properly before storage and store onions at cool temperatures since infection is favored by warm conditions. 	<ul style="list-style-type: none"> Use synthetic pesticides containing malathion, if needed.

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
	<ul style="list-style-type: none"> Sanitation: Clean up all cull and volunteer onions out of fields before planting. Use fall plowing to destroy pupae. 	
<ul style="list-style-type: none"> Onion smuts (<i>Urocystis magica</i> = <i>cepulae</i> and <i>U. colchici</i>) 	<ul style="list-style-type: none"> Where feasible, sow onion seed in noninfested soil or start onions from disease-free sets and transplants. All diseased seedlings and plants should, whenever possible be collected and burned on the spot. Everything should be done to avoid the distribution or movement of smut-infested soil. 	<ul style="list-style-type: none"> Can use fungicides containing chlorothalonil.
Peppers/Chilis		
<ul style="list-style-type: none"> Broad mite (<i>Polyphagotarsonemus latus</i>) 	<ul style="list-style-type: none"> Monitor for malformed terminal buds and stunted growth on any of the suspect hosts. Mites have many natural enemies that often limit populations; predacious mites feed on spider mites, eg (<i>Phytoseiulus persimilis</i> and <i>Amblyseius andersoni</i>); the major predatory mites commercially available for purchase and release are the western predatory mite and <i>Phytoseiulus</i>. Do weed control in and around field. Adequate irrigation is important because water-stressed trees are most likely to be damaged. 	<ul style="list-style-type: none"> Broad-spectrum insecticide treatments for other pests frequently cause mite outbreaks, so avoid these when possible. Natural miticides containing chili pepper extract or sulfur may be used.
<ul style="list-style-type: none"> Powdery mildew (<i>Leveillula taurica</i> (imperfect stage = <i>Oidiopsis taurica</i>) 	<ul style="list-style-type: none"> Use tolerant varieties and raised-bed production. Drain the growing field adequately before planting. Follow proper planting date; do not plant late. Farmers can use sticks and lines to raise tomato plants and fruit into the air to aerate the plant and raise the leaves and fruit away from the soil. 	<ul style="list-style-type: none"> Use natural fungicides containing sulfur or potassium bicarbonate. Or use synthetic fungicides containing chlorothalonil.
<ul style="list-style-type: none"> Anthracois (<i>Colletotrichum</i> species) 	<ul style="list-style-type: none"> Use resistant varieties and clean seed. Control irrigation water. Avoid sprinkler irrigation. Keep bed tops dry. Use frequent crop rotation to non-cucurbits. Sanitation: Inspect transplants for diseased plants and remove. 	<ul style="list-style-type: none"> Use natural fungicides containing copper oxychloride (use only Class II and III products, not Class I, and use eye protection), sulfur or potassium bicarbonate. Use synthetic fungicides containing chlorothalonil.
<ul style="list-style-type: none"> Fusarium Wilt (<i>Fusarium</i> species) 	<ul style="list-style-type: none"> Use of certified disease-free propagation material. Use resistant cultivars against race 1. 	<ul style="list-style-type: none"> No synthetic fungicides are recommended (many farmers tolerate

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
	<ul style="list-style-type: none"> Need positive identification of <i>Verticillium</i> (to avoid confusion with <i>Fusarium</i> wilt) Sanitation: clean equipment to prevent transfer of vectors and inoculum. Rotate to small grains and maize. Use green manure plants. Inoculate soil with <i>Trichoderma</i> species. 	some damage by wilt).
Cabbage		
<ul style="list-style-type: none"> Diamond Back Moth (<i>Plutela xylostella</i>) 	<ul style="list-style-type: none"> For monitoring, use light traps over soap dish to control adult stages and monitoring insect population's dynamics. Sticky bright yellow or blue traps will help to trap and control adult stages. Crop rotation with non-susceptible hosts. Use of trap crops such as inter-planted or edge-planted mustards (but monitor and destroy plants before adults are produced). Mating disruption with sex pheromones has been shown to be effective in reducing diamondback moth populations in Florida. Sprinkle irrigation may reduce the number of caterpillars in the field; if it is applied at dusk, it may limit the activity of adults. 	<ul style="list-style-type: none"> Rotate synthetic insecticides containing carbaryl, deltamethrin, or systemic chemicals containing acetamiprid or imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
Okra		
<ul style="list-style-type: none"> Whiteflies (<i>Bemisia</i> species) 	<ul style="list-style-type: none"> Use of sticky blue or yellow traps, and increase trap density if populations increase. Sanitation: Crop residues must be eliminated from field. Use of barriers made with corn or sorghum. Plant tunnels or covers must be applied to avoid the insect in first 20 days of plant growth. 	<ul style="list-style-type: none"> If spray of pesticides is needed, use a rotational program that includes deltamethrin or imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).
Spinach		
<ul style="list-style-type: none"> Leaf miners (<i>Lyriomyza</i> species) 	<ul style="list-style-type: none"> Natural enemies, especially parasitic wasps, commonly reduce populations of leafminers, unless insecticides applied to control other pests kill them. Hand picking and destruction of infested leaves Use reflective silver plastic soil mulches. Where possible, avoid planting next to infested fields, especially those close to harvest time. Sanitation: Postharvest disking of fields destroys pupae and reduces migration of adult flies into susceptible fields. 	<ul style="list-style-type: none"> Can use homemade extracts of neem tree seeds containing azadirachtins. Rotate among synthetic insecticides containing carbaryl, malathion, or systemic acetamiprid or imidacloprid (but only when plants are in vegetative state, not when flowering due to risk to pollinators and honeybee colony collapse disorder).

Primary Pests	PERSUAP Recommended Preventive GAP/IPM tools/tactics to integrate	PERSUAP Recommended Chemical Controls, when needed
<ul style="list-style-type: none"> • Weeds (broadleaves, grasses) 	<ul style="list-style-type: none"> • Herbicide expenses make farmers use hand weeding, hoeing or cultivation. • At end of the harvest, manual removal of weeds. • Clean weeds along irrigation canals that can transmit weeds to the field. • Use crop rotation. • Use transplants which can out-compete weeds quicker. • Use soil solarization. • Use soil mulches and pruning. • Continue hoe and hand weeding. • Can use drip irrigation to regulate water in the crop and avoid weed emergence. 	<ul style="list-style-type: none"> • Can use pre-emergence synthetic herbicides containing glyphosate or glyphosate isopropylamine salt.

Annex 2: Guidelines for PMPs for Somalia Crops and Beneficiaries

What is a PMP¹²?

Pest Management Plans or Guides provide field crop, livestock production or project decision-makers – farmers and farm managers – with best production practices recommendations, usually adapted by region, crop phenology and seasons. The aims of PMPs are to reduce the risks to production from pests by using a combination of best practices, including IPM, Integrated Vector Management (IVM) and Integrated Weed Management (IWM), that maximize crop or livestock health, and thus resilience to or tolerance of pests, and without an over-reliance on pesticides needed when best practices are not followed. Thus, prevention of pests plays a strongly pivotal role in the PMP, followed closely by management of pests when prevention alone is not adequate for the level of control needed or desired.

Who are the PMP's intended audiences and users?

- Farm land preparation and crop production decision-makers
- Farmers
- Farm managers

Why is a PMP being done?

PMP Objectives:

- Prevent or reduce pest damage risk to agricultural production or health
- Protect the health of farmers, farm family members, laborers and community members from pesticide risks
- Maintain economically sound practices
- Reduce environmental pollution and degradation risks
- Enhance the overall quality and quantity of biodiversity on the sustainable farm work environment
- Respond to foreign market demand for the use of agriculture sector best management practice standards, also called Good Agriculture Practices (GAPs) which include IPM measures, to achieve farm and produce certification
- Comply with local, regional, donor and international laws, conventions, and regulations

Organization of the PMP

The following pieces of crop- or livestock-specific background information are used to build a PMP base

- General information on the crop/livestock/sector
- Crop/livestock common/species names:

¹² PMPs or Year-Round (seasonal) IPM Programs are state of the art in many developed countries, and they help institutionalize IPM in planning and practice. PMPs provide agriculture managers and farmers with a tool to predict and prevent many crop pests of each crop throughout a season. See examples of PMPs at <http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html>, upper left corner under “Year-Round IPM Programs”.

- Crop/livestock developmental stages:
- Production regions and how they differ by soil type, pH, fertility, etc
- Overall concerns and priorities for crop/livestock production
- Crop/livestock cultural best practices
- Crop/livestock Good Agriculture Practices (GAPs) including some IPM (see PERSUAP section on GAPS and IPM) recommendations

Individual Pest Prevention and Management Sections for each of the following pest types:

- Invertebrate (Insects, Mites, Slugs/Snails, Nematodes)
- Diseases (Fungi, Bacteria, Viruses, Other)
- Weeds (annual grasses, broadleaves, perennial grasses, broadleaves, sedges, others)
- Vertebrates (birds, rodents, other)

For each pest type, first, identify overall priorities for pest prevention and management in the target crop or livestock.

Next, identify individual pest species noting the type of damage incurred; part of plant damaged: roots/rhizomes/tubers, stems/stalks, leaves, florescence, or seeds (field or stored); or if livestock, part of animal affected.

To best understand how to manage a pest, one needs to understand how, where, when and on what parts of the plant or animal the pest feeds. For field pests and stored grain/food pests, many PMPs are designed and outlined as follows, *for each major species of pest (insects, mites, slugs/snails, nematodes)*:

- Photographs of each pest, life stages
- Photographs of plant or livestock damage
- Description of the pest, life cycle and survival strategies¹³:
- Description of damage symptoms
- Best Prevention Practices
 - Use any and all of the above GAPs including IPM
 - Country or region-specific information
- Best Management Practices
 - Focus on prevention (above)
 - Country or region-specific information

Information on PMP-recommended pesticides:

Information needed for each pesticide referenced in the above PMP, by pest (so the farmer/farm manager has the information at their fingertips and do not need to refer to other documents and tables to find it):

Pesticide essential information needed

- Active Ingredient (AI) name

¹³ Survival strategies: All pests have survival strategies that allow them to live and breed in each crop's farming systems. Knowing the survival strategies, including overwintering habit and alternate host plants, that are employed by the pest can help with decision making at the farming systems-level (e.g. choice of rotation crops) and also can help to anticipate pest outbreaks.

- Product Trade names (with EPA and WHO Acute Toxicity Classifications in parenthesis)
- Amounts to use per hectare
- Price
- Pre-Harvest Interval (PHI)
- Special comments on best application methods and frequency
- Any resistance management strategies needed
- Pesticide application record sheet
- Guidelines for reducing spray drift
- Re-entry interval (REI): field safe re-entry period after spraying
- Maximum residue levels (MRL) permitted by markets
- Pesticide precautions with use including
- Reading the label
- Legal responsibilities and permitted registration uses
- Permit requirements for possession and use
- Recommended and obligated use of PPE and best practices
- First aid and antidotes
- Transportation best practices
- Storage best practices
- Safe use best practices
- Container disposal best practices
- Leftover pesticide disposal best practices
- Protection of non-pest animals, plants, endangered species and water body quality
- Protect natural enemies & honeybees: <http://www.ipm.ucdavis.edu/PMG/r584310111.html>
- Posting signage in treated fields
- Some chemicals not permitted on processed crops
- Potential for phytotoxicity (crop injury) on some crops
- Documentation and record-keeping on farms

Information needed on Natural Enemies of Pests:

Common Names of Predators and Parasitoids effective against above pests: For a list of common natural enemies of crop pests, see <http://www.ipm.ucdavis.edu/PMG/NE/index.html>. Genera will likely be the same around the world, with different species in different continents, filling similar niches.

Additional Information Needed:

Will there be an IPM Coordinator, an IPM Advisory Committee, Education and Licensing for Applicators, Currency and Approval of the PMP?

Annex 3: Elements of IPM Program

Although farmers are likely using numerous IPM¹⁴ tactics, without really calling them that, IPM philosophy or planning is not generally an active part of crop production in most emerging market countries; thus, a basic understanding of the steps or elements needed in an IPM program are addressed below.

Step 1: Learn and value farmer's indigenous IPM tactics

Most farmers are already using their own forms of GAPs and IPM, many of which are novel, self-created, adapted for local conditions, and many of which work well. These local tools and tactics need to be well understood and taken into account when making PMPs. Accurate assessments of these farmers' GAP and IPM technologies, as well as an understanding of actual losses due to different constraints in farmers' fields are required before designing a crop production and pest management program. Standards and Certification (S&C) farmers will have records of historical pesticide use and trends, as well as information on current use of artisanal or local IPM tactics.

Step 2: Identify key pests for each target crop

Although perhaps up to ten species of pests may impact a crop and yields at different plant growth stages, generally only two or three are considered serious enough to spend money controlling. Farmers should be encouraged to monitor their population size, their life cycle, the kind of damage they cause and actual losses. Note that crop loss figures based on farmers' perceptions of damage and loss are often overestimated.

Step 3: Evaluate all management options

Use of best management practices, preventive measures, and "organic" options to control pest impacts may eliminate the need for synthetic pesticides.

Step 4 Choose IPM methods; identify needs, and establish priorities

Continue dialog with project field staff, ministry extension staff and farmers when choosing methods to be used. Consider the feasibility of attractive methods, including the availability of resources needed, farmers' perceptions of pest problems, their abilities to identify pests, their predators, diseases and parasitoids, and to act upon their observations.

Step 5: Do effective activities and training to promote IPM

Next, identify strategies and mechanisms for fostering the transfer of the needed IPM technology under various project and institutional arrangements, mechanisms, and funding levels. Define what is available for immediate transfer and what may require more adaptation and validation research. Set up an initial planning workshop (with a COP-supported and signed Action Plan) to help define and orient implementation activities, and begin to assign individual responsibilities.

Learning-by-doing/discovery training programs

The adoption of new techniques by small-, medium- and large-holder farmers occurs most readily when program participants acquire knowledge and skills through personal experience, observation, analysis, experimentation, decision-making and practice. At first, frequent (usually weekly) sessions are conducted for 10–20 farmers during the cropping season in farmers' fields by trained instructors or extension agents.

Smallholder support and discussion groups

¹⁴<http://www.fao.org/docrep/006/ad487e/ad487e00.htm>; <http://www.fao.org/docrep/006/ad487e/ad487e02.htm>; http://en.wikipedia.org/wiki/Farmer_Field_School; <http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html>

Weekly meetings of smallholders, held during the cropping season, to discuss pest and related problems can be useful for sharing the success of various control methods. However, maintaining attendance is difficult except when there is a clear financial incentive (e.g., credit, advance knowledge of nearby infestations for early action leading to yield improvement).

Educational material

In many countries, basic written and photographic guides to pest identification and crop-specific management techniques are unavailable or out of date. Videos featuring graphic pictures of the effects of acute and chronic pesticide exposure, and interviews with poisoning victims can be particularly effective.

Youth education

Promoting and improving the quality of programs on IPM and the risks of synthetic pesticides has been effective at technical schools for rural youth. In addition to becoming future farmers, these students can bring informed views back to their communities.

Food market incentives (especially important in the last decade)

Promoting Organic, GlobalGAP, BRC, Fair Trade or other certification for access to the lucrative and rapidly growing S&C systems-driven international and regional food markets can be, and is, a strong incentive to adopt IPM.

Step 6: Partner successfully with other IPM implementers

The following design steps are considered essential.

Articulate the partnership's vision of IPM

Organizations may forge partnerships based on a common commitment to “IPM” – only to discover too late that their visions of IPM differ considerably. It is therefore highly important that partners articulate a common, detailed vision of IPM, centered on the crops and conditions the project will encounter.

Confirm partner institutions' commitment

The extent of commitment to IPM integration into project, design, and thus implementation depends strongly upon the following key variables:

IPM program integration into larger project. The IPM program is likely to be part of a larger “sustainable agriculture” project. The IPM program must fit into a partner's overall goals. The extent of this integration should be clearly expressed in the proposed annual work plan.

Cost sharing. The extent of funds (or in-kind resources) is a good measure of a genuine partner commitment.

Participation of key IPM personnel. Organizations should have staff with expertise in IPM. In strong partnerships, these staff members are actively involved in the partnership.

Step 7: Monitor the fields regularly

At minimum twice a week, farmers should monitor their fields for pests, as some pest populations increase rapidly and unexpectedly; this increase is usually related closely to the stage of crop growth and weather conditions, but it is difficult to predict the severity of pest problems in advance.

Step 8: Select an appropriate blend of IPM tools

A good IPM program draws from and integrates a variety of pest management techniques, like those presented in the above list. Flexibility to fit local needs is a key variable. Pesticides should be used only if no practical, effective, and economic non-chemical control methods are available. Once the pesticide has been carefully chosen for the pest, crop, and environment, it should be applied only to keep the pest population low, not necessarily eliminate it.

Step 9: Develop education, training, and demonstration programs for extension workers

Implementation of IPM depends heavily on education, training, and demonstration to help farmers and extension workers develop and evaluate the IPM methods. Hands-on training conducted in farmers' fields (as opposed to a classroom) is a must. Special training for extension workers and educational programs for government officials and the public are also important.

Step 10: Monitoring, record keeping and evaluation (M&E)

Develop data collection forms and checklists, collect baseline GAP/IPM data at the beginning of the project, and set targets.

For the use and maintenance of Good Agriculture Practices (that include safe pesticide storage, use and disposal), maintain farm or project files of: farmer and farm employee training records certification; farm soil, water, biodiversity, cropping and pesticide use maps; pesticide purchase and stock records; price increases or decreases, chemical application instructions including target pest, type of chemical applied, dosage, time of spray, rates at which pesticides were applied, harvest interval days, application machinery, PPE required and used, and any special instructions on mixing, exposure to children or dangers.

Further, for project staff, beneficiaries, produce processing facilities, food warehouses, seed multipliers, or farmers that store seed or food and deal with stored seed and food pests, there are warehouse BMPs and monitoring reports that incorporate some IPM tactics. These monitoring forms track, by location or warehouse, use of pallets, stacking, general hygiene and sanitation, damaged packages, actual infestations or signs of rodents, molds, insects, drainage, locks and security measures, use of IPM tactics including least toxic chemicals and strict BMPs, including restricted access, for use of common but hazardous fumigants like aluminum phosphide.

Annex 4: Acute Toxicities of Pesticides: EPA and WHO Classifications

General Toxicity

Pesticides, by necessity, are poisons, but the toxicity and hazards of different compounds vary greatly. Toxicity refers to the inherent intoxicating ability of a compound whereas hazard refers to the risk or danger of poisoning when the pesticide is used or applied. Pesticide hazard depends not only on toxicity but also on the chance of exposure to toxic amounts of the pesticide. Pesticides can enter the body through oral ingestion, through the skin or through inhalation. Once inside the body, they may produce poisoning symptoms, which are either acute (from a single exposure) or chronic (from repeated exposures or absorption of smaller amounts of toxicant).

EPA and WHO Toxicity Classifications

Basically, there are two systems of pesticide toxicity classification. These are the USEPA and the WHO systems of classification. It is important to note that the WHO classification is based on the active ingredient only, whereas USEPA uses product formulations to determine the toxicity class of pesticides. So, WHO classification shows relative toxicities of all pesticide active (or technical) ingredients, whereas EPA classification shows actual toxicity of the formulated products, which can be more or less toxic than the active ingredient alone and are more representative of actual dangers encountered in the field. The tables below show classification of pesticides according to the two systems.

a) USEPA classification (based on formulated product = active ingredient plus inert and other ingredients)

Class	Descriptive term	Mammalian LD ₅₀		Mammalian Inhalation LC ₅₀	Irritation		Aquatic invert/ fish (LC ₅₀ or EC ₅₀) ²	Honey bee acute oral (LD ₅₀)
		Oral	Dermal		Eye ¹	Skin		
I	Extremely toxic	≤50	≤200	≤0.2	Corrosive	Corrosive	< 0.1	
II	Highly toxic	50-500	200-2000	0.2-2.0	Severe	Severe	0.11-1.0	< 2 µg/bee
III	Moderately toxic	500-5000	2000-20000	2.0-20	No corneal opacity	Moderate	1.1-10.0	2.1-11 µg/bee
IV	Slightly toxic	≥5000	≥20000	≥20	None	Moderate or slight	10.1-100	
	Relatively non-toxic						101-1000	
	Practically non-toxic						1001-10,000	> 11 µg/bee
	Non-toxic						> 10,000	

¹ Corneal opacity not reversible within 7 days for Class I pesticides; corneal opacity reversible within 7 days but irritation persists during that period for Class II pesticides; no corneal opacity and irritation is reversible within 7 days for Class III pesticides; and Class IV pesticides cause no irritation

² Expressed in ppm or mg/l of water

b) WHO classification (based only on active or 'technical' ingredient)

Class	Descriptive term	Oral LD ₅₀ for the rat (mg/kg body wt)	Dermal LD ₅₀ for the rat (mg/kg body wt)
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		Solids	Liquids	Solids	Liquids
Ia	Extremely hazardous	≤5	≤20	≤10	≤40
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	20-2000	100-1000	400-4000
III	Slightly hazardous	≥501	≥2001	≥1001	≥4001
U	Unlikely to present acute hazard in normal use	≥2000	≥3000	-	-

Annex 5: PERSUAP Analyses of Active Ingredients in Pesticides Available in Somalia

Introduction to Annex 5

Annex 5 below compiles all of the AIs in pesticides for which BEO approval is being requested and available for use in Somalia and proposed for imminent registration. Project decision-makers—especially those who interface at the field level with beneficiary farmers—are encouraged to look at the label of potential pesticide choices to determine the AIs contained in them and then use this Annex as a quick reference guide to attributes and issues with each chemical.

The pesticide attributes include pesticide class (to manage resistance by rotating chemicals from different classes), EPA registration and Restricted Use Pesticide (RUP) status (to comply with Regulation 216) and acute toxicity (judged by this document to be safe, or not, for smallholder farmers—most Class I chemicals are not considered safe for smallholder farmers to use). Annex 5 also presents chronic health issues, water pollution potential, and potential toxicities to important non-target organisms like fish, honeybee pollinators, birds and several aquatic organisms.

Further, Annex 5 contains basic pieces of human safety and environmental data needed for the various analyses required throughout the PER; ergo it is referred to throughout this document. Thus, this PERSUAP provides useful tools for evaluating and choosing among IPM options, including natural and synthetic pesticides, while adhering to 22 CFR 216.

See Annex 5 Matrix, below.

Key to matrix:

RUP: Few = one or two products; Some = a third of products; Most/All = most or all products

WHO Acute Toxicity Classes: O = Obsolete; Ia = Extremely Hazardous; Ib = Highly Hazardous; II = Moderately Hazardous; III = Slightly Hazardous; U = Unlikely to present acute hazard in normal use; NL = Not Listed

EPA Acute Toxicity Classes: I = Extremely Toxic; II = Highly Toxic; III = Moderately Toxic; IV = Slightly Toxic; NL = Not Listed

Chronic Human Toxicity: KC = Known Carcinogen; PC = Possible Carcinogen; LC = Likely Carcinogen; ED = Potential Endocrine Disruptor; RD = Potential Reproductive & Development Toxin; P = Risk of Parkinson's; NL = Not Listed

Ecotoxicity: NAT = Not Acutely Toxic; PNT = Practically Not Toxic; ST = Slightly Toxic; MT = Moderately Toxic; HT = Highly Toxic; VHT = Very Highly Toxic; NL = Not Listed

References used to find pieces of data contained in Annex 5: See references at the end of the report.

2014 Somalia Insecticides and Fumigant

Active Ingredients	Class	EPA Registered	Restricted Use Pesticide	WHO Acute Toxicity Class	EPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	Amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
acetamiprid	neonicotinoid	yes	no	NL	III	NL	potential	NAT	MT	HT				NAT		
allicin (garlic extract)	natural plant spice	yes	no	NL	III	NL	no data	VHT	HT	HT	MT	MT	MT	VHT	VHT	ST
amitraz	formamidine	yes	no	III	III	PC, ED, RD	no data	MT	PNT	ST	ST			NAT		ST
azadirachtin (neem)	natural plant extract	yes	no	NL	III	ED	no data	ST	NAT	NAT	MT				MT	
beta-cyfluthrin	synthetic pyrethroid	yes	few	II	II, III	ED	no data	VHT	HT	PNT			ST		VHT	VHT
capsaicin (chili extract)	natural plant spice	yes	no	NL	III	NL	no data						ST			
carbaryl	carbamate	yes	no	II	II, III	PC, ED	potential	MT	HT	PNT	MT	VHT	ST	HT	HT	MT
cypermethrin	synthetic pyrethroid	no hort	some	NL	II, III	PC, ED, RD	no data	HT	HT	PNT			MT	VHT	VHT	VHT
deltamethrin	synthetic pyrethroid	yes	cotton	II	II, III	ED	no data	HT	MT		VHT		NAT		VHT	VHT
diatomaceous earth	mineral extract	yes	no	U	III	NL	no data									
imidacloprid	neonicotinoid	yes	few	II	II, III	NL	potential	NAT		MT					VHT	
malathion	organophosphate	yes	no	III	II, III	PC, ED	potential	MT	HT	MT	HT	ST	VHT	MT	VHT	HT
permethrin	pyrethroid	yes	no	II	III	PC, ED	no data	VHT	VHT	PNT	ST	ST	ST	VHT	MT	MT
pirimiphos-methyl	organophosphate	yes	no	III	II, III	NL	no data	MT	HT	MT		MT			VHT	VHT
pyrethrum (flower)	natural extract	yes	no	II	III	PC	no data	HT	HT	ST		MT		HT		

2014 Somalia Acaricide/Miticides

Active Ingredients	Class	EPA Registered	Restricted Use Pesticide	WHO Acute Toxicity Class	EPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity								
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects	Plankton
amitraz	formamidine	yes	no	III	III	PC, ED, RD	no data	MT	PNT	ST	ST			NAT		ST
capsaicin (chili extract)	natural plant spice	yes	no	NL	III	NL	no data						ST			
cypermethrin	pyrethroid	no hort, yes lvstk	some	NL	II, III	PC, ED, RD	no data	HT	HT	PNT			MT	VHT	VHT	VHT
deltamethrin	pyrethroid	yes	cotton	II	II, III	ED	no data	HT	MT		VHT		NAT		VHT	
pyrethrum (flower)	natural extract	yes	no	II	III	PC	no data	HT	HT	ST		MT		HT		
sulfur	inorganic	yes	no	U	III	NL	no data	NAT	NAT	NAT						NAT

2014 Somalia Fungicides

Active Ingredients	Class	EPA Registered	Restricted Use Pesticide	WHO Acute Toxicity Class	EPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity							
								fish	bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects
chlorothalonil	chloronitrile	yes	no	NL	II, III	PC	potential	VHT			HT		ST	VHT	MT
copper oxychloride	inorganic	yes	no	NL	II, III	NL	no data	MT	MT	MT		MT			VHT
potassium bicarbonate	inorganic	yes	no	NL	III	NL	no data	ST	MT					ST	NAT
sulfur	inorganic	yes	no	U	III	NL	no data	NAT	NAT	NAT					NAT

2014 Somalia Herbicides

Active Ingredients	Class	EPA Registered	Restricted Use Pesticide	WHO Acute Toxicity Class	EPA Acute Toxicity Classes	Chronic Toxicity	Groundwater contaminant	Ecotoxicity							
								fish	Bees	birds	amphibians	worms	Mollusks	Crustaceans	Aquatic Insects
glyphosate	phosphonoglycine	yes	no	U	II, III	NL	potential	ST	ST	NAT		PNT		MT	
glyphosate, isopropylamine salt	phosphonoglycine	yes	no	NL	II, III	NL	potential	ST	ST		ST	NAT	ST	NAT	NAT

Annex 6: Training Topics and Safe Pesticide Use Web Resources

GAP/IPM

- Pest identification: How to recognize common important pests and diseases
- Monitoring: The importance of frequent crop monitoring for pests, diseases and weeds
- GAP and IPM concepts, tactics and tools found in Annex 1 that can reduce pesticide use and associated risks on specific pests of project target crops
- PMPs—Pest Management Plans: Creating and using these farm crop-management tools

Pesticides

- Understanding pesticides: Quality, types, classes and acute toxicities of common pesticides
- Regulations: US, EU and Somalia laws that guide pesticide registration and use
- Natural pesticides: Raise awareness of and promote the use of natural pesticides found in Annexes 1 and 10 as well as green-label (lowest human toxicity) synthetic pesticides with relatively low risks
- Spot Treatments: The importance of spot treatments if needed (instead of crop-wide treatments)
- MSDS: How to use MSDSs for pesticide-specific information on risks and risk reduction measures
- REI—Re-Entry Intervals: Pesticide-specific risks associated with entering a sprayed field too soon after the spray operation
- PHI—Pre-Harvest Interval: Pesticide-specific risks associated with harvesting a crop before pesticides have had a chance to break down
- MRL—Maximum Residue Level: Risks associated with pesticide residues on human food
- Vulnerable individuals: The importance of keeping children, pregnant women, elderly and infirm away from the field while spraying and kept out after spraying
- Human and environmental risks: Risks associated with more commonly-used pesticides (use information from MSDSs and Annex 5)
- When to spray: Early in the morning, late in the afternoon, or night without wind or rain
- Use of recommended PPE: Why it is used (see product MSDSs, product labels and web reference below)
- Proper use and maintenance of sprayers, including proper sprayer calibration and spray nozzle choice
- Proper clean-up & post spray hygiene
- Safe Use: How to purchase, transport, store and use pesticides safely (“safe purchase” requires quality, brand-name products)
- Maintenance: of PPE and sprayers
- Monitoring for the development of pesticide resistance
- Proper collection and disposal of pesticide rinseate and packaging (see disposal web reference below and MSDSs)
- The use of pesticide spray buffer zones near schools, water resources, organic crop production, apiaries, bird sanctuaries, biodiversity enclaves, national parks or other sensitive areas.
- How to reduce and mitigate risks to critical environmental resources and biodiversity (found in PER Factors E and G)
- Honeybees: Ensuring pesticide applicators notify beekeepers about spray activities, and spray early morning or late afternoon when no heavy winds or rain are present
- Water Pollution: Raise awareness of pesticides (especially some herbicides) with high ground water contamination potential where water tables are high or easy to reach (use Annex 5 and MSDSs)

- Exposure routes: Ways pesticides enter the body and ways to mitigate entry
- Basic first aid: Understanding how to treat pesticide poisonings (see first aid web reference and MSDSs)
- Record-keeping: Pesticide used, when used, which crop, how applied, who applied

Web Safe Pesticide Use Training Resources

General Mitigation of Potential Pesticide Dangers General Measures to Ensure Safe Use:

http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

EPA Recommended Worker Protection Standards:

<http://www.epa.gov/oppfead1/safety/workers/equip.htm> (all types of PPE)

<http://www.cdc.gov/nasd/docs/d001701-d001800/d001797/d001797.html> (respiratory PPE)

Routes of Pesticide Exposure and Mitigation of Risks:

http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

Basic First Aid for Pesticide Overexposure:

http://pdf.usaid.gov/pdf_docs/PNADK154.pdf, Chapter 13

International PIC & POPs Lists:

PIC Pesticides and Industrial Chemicals (<http://www.pic.int>)

POPs Pesticides and Chemicals (<http://www.pops.int>)

Pesticide Disposal Options:

<http://www.epa.gov/oppfead1/labeling/lrm/chap-13.htm>

Annex 7: Field Monitoring Form for Farmer Best Practices including GAP and IPM options

Name of USAID Staff Responsible for Monitoring Demonstration Farms: _____

Name of Demonstration Farmer: _____ Crop: _____ Date: _____

What are the major pests encountered by the farmer?: _____

Which of the *attached* Preventive and Curative GAP and IPM tools and tactics are used by farmer?

Are pesticides used by demo farmer? Yes___ No___

How are pesticides applied? backpack sprayer___ other___

What are the names of the pesticides used?: _____

Which PPE does farmer have and use? gloves___ overalls___ boots___ respirator___ goggles___

Has the farmer had IPM and Safe Pesticide Use training? Yes___ No___

Are there any empty pesticide containers scattered in the field? Yes___ No___

Are there signs that the backpack sprayer has leaks? Yes___ No___

Does the farmer understand the pesticide label information? Yes___ No___

Is the pesticide stored safely out of the house or away from kids? Yes___ No___

Does the farmer use gloves for mixing the pesticide with water? Yes___ No___

What times of the day are the pesticides applied? _____

Are pesticides applied during rain or windy conditions? Yes___ No___

Are women or children permitted to apply pesticides? Yes___ No___

Are empty pesticide containers are used to store water? Yes___ No___

Does the farmer rinse equipment away from streams and open water? Yes___ No___

Does the farmer wash clothes after applying pesticides? Yes___ No___

How does the farmer dispose of empty pesticide containers? puncture/bury___ burn___

Is there any evidence that pesticides are becoming less effective? Yes___ No___

Preventive and Curative GAP and IPM options:

Preventive	Preventive	Curative
Soil nutrient, texture and pH testing	Farmer ability to correctly identify pest predators, parasitoids and diseases	Mechanical insect control by hand picking
Pest resistant/tolerant seed/plant variety	Weekly field scouting to assess pest levels/damage	Farmers make & apply local artisanal plant extracts (neem, pyrethroid, garlic, chili, other)
Early/late plantings or harvestings to avoid pests	Use of trap crops to trap and destroy pests	Weed control by machine cultivation, hoe or hand
Seed treatment with pesticides	Removal/pruning of diseased or heavily infested plants/tree branches	Purchase and release of predators or parasitoids to control major pests
Soil moisture testing	Planting parasite-attracting plants on field margins	Use of pheromone traps to reduce overall pest levels
Raised-bed production or mounding	Put baits and use other practices to encourage predator/parasite build-up	Use of pheromone inundation to confuse pest mating
Irrigation and drip irrigation	Use of pheromone traps to monitor pest levels	Spot treatment of pest hotspots with insecticides, miticides or fungicides
Use of natural fertilizers (manure, compost)	Inter-planting crops with aromatic herbs (celery, cilantro, parsley, dill or local plants) that repel pests	Area spraying (complete field coverage) using synthetic and natural insecticides, miticides or nematocides
Use of purchased mineral fertilizers	Mulching with organic materials or plastic to control weeds	Use of synthetic and natural fungicides or bactericides
Combinations of organic and mineral fertilizers	Plant living barriers or bamboo/tree barriers on windward edge of field	Use of herbicides for weed control
Crop rotation	Exclude insect pests by using vegetable tunnels and micro-tunnels	Farm use of a locked storage building for pesticides
Use of green manure crops	Use of biodiversity or energy conservation practices	Farmer use of pesticide in-ground compost trap for depositing and capturing spilled or leftover pesticides
Farmer ability to correctly identify pests and their damage	Crop stalks, residue and dropped fruit destruction/composting season end	Farmer use of receptacle for empty pesticide bottle disposal

FARM NAME

FARM NAME

--

PACKED

Kg / Ltr

TRADE NAME OF CHEMICAL

MANUFACTURER

TRADE NAME OF CHEMICAL

REGISTRATION DETAILS

[illegible]

CONCENTRATIONS - %

PLEASE NOTE

Only trained staff members allowed to issue and handle CHEMICALS

Inventory must be checked and updated at least once every week and documented

Please use one form per chemical type and packed weight

[illegible]

Approved by : A Hines

Chemical Stock Record - E 8.6.15, NC 1.13
Version 2

Issue Date : 04 Oct. 2007
Page 1 of 1



CHEMICAL APPLICATION INSTRUCTIONS - JOVAC

DATE

PRODUCT

LAND NUMBER

BLOCK NUMBER

CHEMI	CHEMICAL PRODUCT(S) TO BE APPLIED	ACTUAL DOSAGE PER LAND	Water Vol.	Har.	Target	INSTRUCTIONS FOR APPLICATION
				Int. day		

APPLICATION MACHINERY TO BE USED

Foliar Application

INSTRUCTION GIVEN BY (NAME)

SIGNATURE

WHO EXECUTED THE INSTRUCTION

NAME

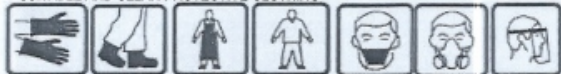
SIGNATURE

Time of Spray

Start

Finish

SUITABLE AND CLEAN PROTECTIVE CLOTHING



Gloves

Boots

Raincoat

Overall

Nose/ Mouth

Respirator

Eye Pro.

SPECIAL INSTRUCTIONS WHEN HANDLING CHEMICALS



Handling Dry Concentrate

Handling Liquid Conc.

Water After Use

Keep Locked No Children

Chemical Are Dangerous

PROTECTIVE CLOTHING ISSUED TO

Name

Name

Name

Signature

Signature

Signature

Name

Name

Name

Signature

Signature

Signature

WAS THERE EXCESS SPRAY MIX?

YES

NO

APPROXIMATE QUANTITY

 Liters

WHAT HAVE YOU DONE WITH THE EXCESS SPRAY MIX?

EXECUTED BY (NAME)

Spray Washing

YES

NO

Lit of water

Location

Washing

Disposal

Area

Weather Conditions

Rain

Dry

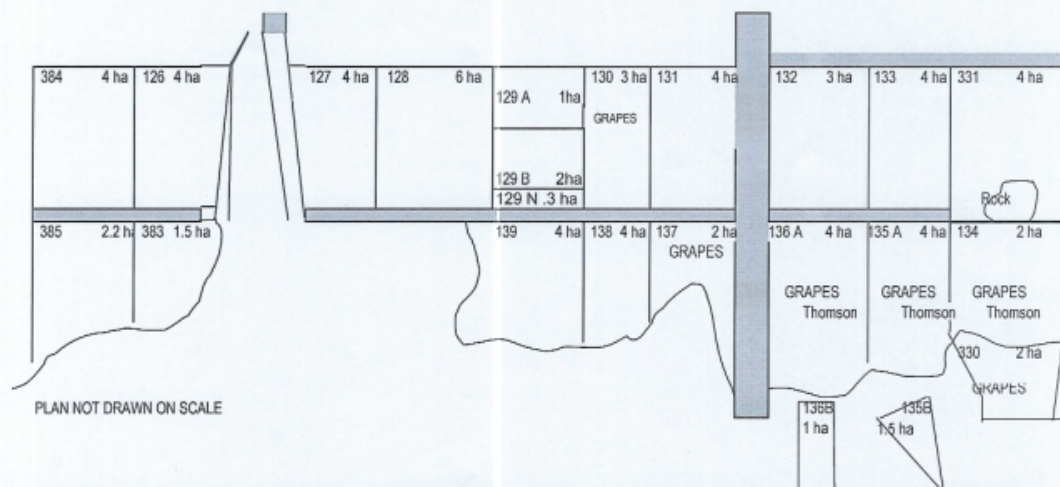
Clody

Tempture

Sunny

Wind

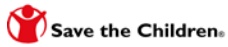
YES / NO



PLAN NOT DRAWN ON SCALE

Approved by: A. Hines
Prepared by: E. NairChemical Application Instructions - ER.3.1-8.3.3, 8.3.5, 8.3.7-8.3.9, 8.6.2-8.6.3, 12.5.3, NC 1.10, 1.11
Version 9Issue Date: 20.4.06
Page 1 of 1

1.- Control Card for Pesticides Use.- This card will stay with farmer, to keep a record on the use of pesticide by crop.



CONTROL FORM FOR THE USE OF PERTICIDES

GENERAL DATA			
FARMERS NAME			
Community:	Municipality:	Province:	Altitude:
USE OF PESTICIDES - 1st TREATMENT			
CROP:		SURFACE:	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental conditions:			
Justification for use			
Other recommended control measures			
Result of application			
NAME AND SIGNATURE OF IG AND NRM SUPERVISOR:			
USE OF PESTICIDES - 2nd TREATMENT			
CROP:		SURFACE:	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental conditions:			
Justification for use			
Other recommended control measures			
Result of application			
NAME AND SIGNATURE OF IG AND NRM SUPERVISOR:			

Annex 9: PERSUAP References

Baker EL, Zack M, Miles JW, Alderman L, Warren M, Dobbins RD, Miller S, Teeters WR (1978) Epidemic malathion poisoning in Pakistan malaria workers. The Lancet, January: 31–33.

Websites: Website references used to develop the PERSUAP

International Treaties and Conventions:

POPs website: <http://www.pops.int>

PIC Website: <http://www.pic.int>

Basel Convention: <http://www.basel.int/>

Montreal Protocol: <http://www.unep.org/OZONE/pdfs/Montreal-Protocol2000.pdf>

Pakistan malaria poisonings: http://pdf.usaid.gov/pdf_docs/PNACQ047.pdf.

Pesticide poisonings:

http://www.panna.org/resources/panups/panup_20080403

<http://magazine.panna.org/spring2006/inDepthGlobalPoisoning.html>

IPM and PMP websites:

<http://www.ipm.ucdavis.edu/>

<http://edis.ifas.ufl.edu/pg058>

<http://www.ipmcenters.org/pmsp/index.cfm>

http://www.dpi.nsw.gov.au/data/assets/pdf_file/0005/154769/Cotton-pest-management-guide-1.pdf

Pesticide Research Websites:

<http://extoxnet.orst.edu/pips/ghindex.html> (Exttoxnet Oregon State database with ecotox)

http://www.agf.gov.bc.ca/pesticides/f_2.htm (all types of application equipment)

<http://www.greenbook.net/Search/AdvancedSearch> (pesticide Material Safety Data Sheets)

<http://www.epa.gov/pesticides/reregistration/status.htm> (EPA Registration Eligibility Decisions)

Ecotoxicity:

<http://www.ohioline.osu.edu/hyg-fact/2000/2161.html> (pesticide toxicity to honeybees)

<http://wihort.uwex.edu/turf/Earthworms.htm> (pesticide toxicity to earthworms)

Safety:

<http://www.epa.gov/opbtpd1/biopesticides/ingredients/index.htm> (EPA regulated biopesticides)

<http://www.ipm.ucdavis.edu/index.html> (IPM, PMPs and pesticide recommendations)

<http://edis.ifas.ufl.edu/pdf/PI/PI07300.pdf> (Restricted Use Pesticides)

<http://www.epa.gov/pesticides/health/> (EPA Health & Safety)

<http://www.epa.gov/opppmsd1/PPIsdata/index.html> (EPA pesticide product information)

PPE:

<http://www.epa.gov/oppfead1/safety/workers/equip.htm> (all types of PPE)

<http://www.cdc.gov/nasd/docs/d001701-d001800/d001797/d001797.html> (respiratory PPE)

Safe Pesticide Use (SPU)

EPA's Worker Protection Safety (WPS) program: <http://www.epa.gov/pesticides/health/worker.htm>

EPA's Using Pesticides Safely program: <http://www.epa.gov/pesticides/health/safely.htm>

EPA's Human Health Issues website: <http://www.epa.gov/pesticides/health/human.htm>

EPA's Emergency Information website: <http://www.epa.gov/pesticides/health/emergency.htm>

EPA's website on PPE provides guidance on safety equipment needed for pesticide use:

<http://www.epa.gov/oppfead1/safety/workers/protective-equipment.html>

The United Nations (UN) Food and Agriculture Organization (FAO) provides Guidelines for Good Practice for Ground Application of Pesticides at: <http://www.fao.org/docrep/006/y2767e/y2767e00.htm>.

The World Health Organization (WHO) also has SPU resources at:

http://www.who.int/water_sanitation_health/resources/vector385to397.pdf.

Annex 10: 2014 Somalia Available Pesticides Proposed for PERSUAP Analysis

2014 Somalia Pesticides found on-farm, in shop, or street markets

Insecticides

Company	Product	Concentration	Formulation	Active Ingredients	Label Color
from Jordan					
CHEMVET (Jordan)	Agrozon	600	EC	Diazinon	Yellow
CHEMVET (Jordan)	Super Ban	550	EC	Cypermethrin 50gm Chloropyrifos 500gm	yellow
CHEMVET (Jordan)	Agroban	480	EC	Chloropyrifos 480gm	yellow
CHEMVET (Jordan)	Chem-Star	5	EC	Alphacypermethrin 50gm	yellow
CHEMVET (Jordan)	Carbochem	25	EC	Carbosulfan 250gm	Yellow
CHEMVET (Jordan)	Agro amiral	57	EC	Malathion 570gm	Yellow
VETAGRO (Jordan)	Carbaryl	85%	WP	Carbaryl 85%w/w	Yellow
VETAGRO (Jordan)	Agonite	90	SP	Methomyl 900gm	Red
VAPCO (Jordan)	Vapcocidin	10	EC	Fenvalerate	Yellow
VAPCO (Jordan)	Vapcothrin	5%	EC	Cyfluthrin 5%	Yellow
VETAGRO (Jordan)	Cypermethrin	10%	EC	Cypermethrin 10w/w	Yellow
VETAGRO (Jordan)	Dicovos	50%	EC	Diclorvos 500gm	Red
VETAGRO (Jordan)	New Star	5%	EC	Alphacypermethrin	Green
VETAGRO (Jordan)	Concord	40%	EC	Triazophos 400gm	Red
VETAGRO (Jordan)	Picador	20%	SP	Acetamiprid 20%w/w	yellow
VETAGRO (Jordan)	New alpha	5%	EC	Alpha cypermethrin	Green
from Malaysia					
HEXTAR CHEMICALS Bhd, Malaysia	Agent	505	EC	Chlorpyrifos 45% Cypermethrin 4.6%	Red
HEXTAR CHEMICALS Bhd, Malaysia	Agritox	10	G	Carbofuran	Yellow
HEXTAR CHEMICALS Bhd, Malaysia	Alpha		EC	Cypermethrin 45.6 Chlorpyrifos 4.6	Red
from China					

CHEM PHARM CO (China)	Agonita	90	SP	Methomyl 900gm	Red
CHEM PHARM (China)	Me-Concord	40%	EC	Triazophos 400gm	Red
CHEM PHARM (China)	Meadcocidin	10	EC	Fenvalerate 100gr	None
PRC (China)	Deltamethrin	2.5	EC	Deltamethrin 2.5%	Yellow
PRC (China)	Ayaxley	40%	EC	Triazophos	Red
PRC (China)	NEW-GALAX	5%	EC	alpha-cypermethrine 50 gm	Yellow
from Germany					
Bayer, East Africa, Nairobi Distributors	Bull dock	0.5g	G	Betacyfluthrin 0.5g/kg	Blue
Fungicides					
CHEMVET (Jordan)	Ranvil	5	EC	Hexaconazole 50gm	Blue
VETAGRO (Jordan)	Agroxy	50%	WP	copper oxychloride 500gm	Blue
HEXTAR CHEMICALS Bhd, Malaysia	Odyssey	500	SC	Chlorothalonil 40%w/w	Yellow
HEXTAR CHEMICALS Bhd, Malaysia	Helix	5	SC	Hexaconazole 50gm	Yellow
Stored Grain					
Twiga Chemical Indus. Uganda, Distributor Ecel crop care (Mombay, India)	Celphos tablet			Alluminium phosphide 56%	Red
Syngenta	Actellic Plus			Pirimiphos-methyl Permethrin	Yellow Yellow
Herbicide					
CHEMVET (Jordan)	Glyphoherb	480	SL	Glyphosate	Blue
HEXTAR CHEMICALS Bhd, Malaysia	Supremo	41	SL	Glyphosphate isopropylamine	Blue
Acaricide					
Ultra vetis East Africa (Kenya)	Steladone	300	EC	chlorfenvinphos	None
PRC (China)	Ayaxley	40%	EC	triazophos	Red
SAAPco LTD (India)	ECOTIC	10%	EC	cypermethrin	Blue
VAPCO (Jordan)	Vapcocidin	10	EC	fenvalerate	Yellow
Norbrook (UK) (requested by SATG)	Norotraz	12.5% w/v		amitraz	
Natural and Homemade Extracts					
chili pepper extracts				capsaicin	
garlic extract				allicin	
diatomaceous earth				diatomaceous earth	
Neem tree seed extract				Azadiracthin	
Pyrethrum flower extract				pyrethrum	
sulfur				natural sulfur product	
potassium bicarbonate				natural potassium bicarbonate	
copper oxychloride (see above)				natural copper product	